August 1939

RADIO AND HOBBIES IN AUSTRALIA

VOL. 1, No. 5

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NEXT MONTH

In our next month's issue, we hope to describe for you a really midget set, just the thing to "give you a tune" as one man puts it, from the local stations. You can probably build the 4/39 for about ten pounds, but "Big Jim" will cost you perhaps half this sum. It won't compare in performance with the 4/39, but it will provide good tone and volume from most of the locals. It will have only three valves, but will use a loud speaker, and probably be housed in a little cabinet of its own. In addition, we shall try to have ready for you, a battery short wave set, for which many of you have asked during the last few months.

Thanks again for all your encouraging letters. It is grand to know that our paper is meeting with such approval and success.

EDITOR:
A. G. HULL.

TECHNICAL EDITOR:
JOHN MOYLE.

PUBLISHED BY WIRELESS NEWSPAPERS, PTY., LTD., 60-66 ELIZABETH STREET, SYDNEY.

ADVERTISEMENT

A Successful Australian Valve Industry . . .

With the Editors

MIDGET SETS

The present-day trend in radio receivers, is in favor of the very small design, with a big performance. A glance at the radio Press advertising will demonstrate this very clearly, for midget A.C. sets and portable receivers practically dominate the field.

This is the reason we have made the main feature of this issue, the 4/39 receiver. It isn't as much a midget as some which can be obtained, but it is still very much smaller than anything we have produced to date.

Many people, of course, don't like sets made too small. They are too easily pushed off the table, or jerked to destruction if some clumsy person should step on the power lead. The 4/39, we consider, has a cabinet just nicely placed between a standard mantel model, and a very small set.

It has features which are not obtainable in any midget sets available at present, with the possible exception of one or two. You may not think that such a tiny set could possibly tune in overseas short wave stations at good volume. If you do, you will be surprised when you hear a 4/39. There is only a certain amount of gain that anyone can get from a certain combination of valves, but we think we have just about reached it. Everyone who has heard the set has been very much impressed with its short wave performance, and we have been hard-pressed to keep it out of the hands of more than one enthusiastic friend.

We are quite confident that this set will be even more popular than the portable receiver recently described, which has exceeded all our expectations in its ready acceptance everywhere.

At all times, we welcome suggestions from our readers, for possible articles to be included in our paper. We have had much valuable help from correspondents, particularly in the last few months, and have used many of their ideas. We would mention here that if you think you can write interesting articles for "RADIO AND HOBBIES" we will be glad to consider them at any time, and will pay for them on publication. Should your proposed article entail much work, let us have a summary of what you intend, and if it sounds hopeful, we will let you know what to do about it. Preference will be given to articles covering subjects which are not easily dealt with by our own staff, although there is really no limitation to subject matter, whether dealing with Radio or Hobbies.

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THE HEART OF YOUR RADIO SE

The invention of the radio valve can be regarded as the most important event in the history of radio development. For it was the valve, and its development through the years, that made radio of to-day a possibility. Circuit design, in all its complexities, and its ramifications, has hinged on the valves which are necessary to make it practicable. As valves are improved, then and then only, can the design of radio receivers improve also. At the present time, more importance is placed on the valve, and its functions in a receiver, than on any one other component. The pictures shown here are based on the valve factory of the Amalgamated Wireless Valve Co., Australia's first valve manufacturing organisation, with its big factory at Ashfield.

IN the early days of radio, valves were imported from overseas, from England, the Continent, and America, because comparatively few were used here in Australia. For that matter, the same may be said about radio receivers. The Australian market was a small one, and no one could afford the huge outlay required to make valves locally.

Even when imported sets were prohibited, and Australian factories began to establish themselves in all parts of the country, still the consumption valves was not great enough to warr manufacture in Australia.

A few years ago, however, the A Valve Co. was formed, in the be that Australian radio was destined have a big future. The men behind gambled on this fact, and were actu investing for the future, which has r arrived.

Their early efforts, and their det mination to succeed, has now bo fruit. To-day, nearly all Australi valves are made in this country, a only special types, which are not u in large enough quantities to make i manufacture a paying proposition, imported from overseas.

Almost every month, a few more t are being added to the list which co from the A.W. Valve Co. works. Th are now kept going almost night day, pouring out the magic little re lamps which bring your radio sig to your fireside.

It is not possible to mount the valve assemblies by machinery, so specially trained girls do the work instead. Here we see one of the mounting benches, with valves going along the line. The curious device in front of the girl in the foreground is a spot-welder, used for welding together the various wires which hold the assembly together. The girls work accurately and deftly despite the tiny parts they are putting together.

FRAGILE BUT STRONG

A radio valve is a marvellous dev If you have ever broken the glass velope of such a valve, and obse the intricate construction of the ments, you must have wondered anything so finely made could be p duced in large quantities, every one actly the same, and able to withst an amazing amount of misuse physical shock.

Only the greatest care in design, all the knowledge and science wh would be lavished on a big enginee undertaking, makes such a thing p sible. In fact, the problems of v manufacture are made all the gre because of the very fine limits impo on machines and men.

AUTOMATIC MACHINERY

The secret of the whole busines valve manufacture lies in the inte use of automatic machinery. Apart considerations of economy, it would viously be impossible for every valv be made by hand. Too much time be taken, and the human elemen c not possibly maintain the high accu demanded.

As a result, wherever possible valve is put together by auto machinery, which, when once se

IS THE MARVELLOUS RADIO VALVE

will continue to perform its particular duties hour after hour, so that the part it plays in manufacture and assembly is done quickly and thoroughly.

PURITY OF MATERIALS

A valve, apart from requiring the minutest accuracy in mechanical assembly, must be made of materials which are chemically pure. As a result, meticulous care is paid to the constitution of each, so that the valve will give its life service free from any unwanted chemical or electrical effects of its own!

The use of active cathodes which are sprayed with special oxides as active material demands purely chemical work of the highest order. Some of these cathodes are coated with material which weighs as little as 21 ten-millionths of a pound! No more and no less, or the valve will not perform exactly the same way as the one before it and the one which comes after.

The materials which go into the manufacture of a valve are many and varied. There are only 91 known elements in the universe. Fifty-one of these are used in larger or smaller quantities in the manufacture of valves.

PROCESSES

The layman sees a valve as a glass envelope, with a base attached, and he plugs this into his set when a new one is required.

Inside that glass bulb will be found the maze of wires and plates which make up the main assembly of the valve. This assembly will vary according to the simple or complex work which the valve has to do.

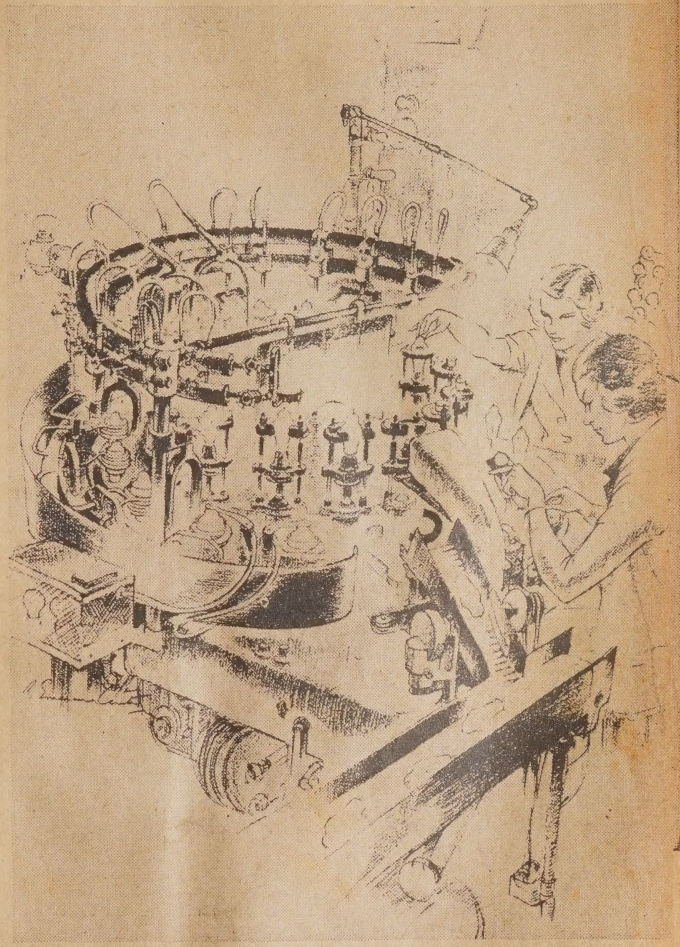
The bulb itself must be exhausted of air, so that the valve operates in almost a complete vacuum. This evacuation process has been evolved after many years of the most intensive research, for a "gassy" valve, or one which has more than the allowable percentage of gases inside it, will not behave itself as it should, and, in most cases, will be useless for radio purposes.

Not only has the air to be pumped from the bulb, but the metals used in the valve itself must not of themselves emit gases during the valve's life. This may seem to be carrying things a bit too far, but it is a fact that the wires and the plates used in the valve can give off enough unwanted gases to entirely spoil its operation.

For this reason, before the valve is sealed up on the "Sealex" they are heated to a very high temperature, so that practically all the gases which might be released are driven off and pumped out before the bulb is finally sealed.

As a final precaution, when the bulb is sealed, a chemical compound, mostly magnesium, is fired inside the bulb, the effect of which is to complete the work of evacuation.

Because the valves are revolving in the machine when this is done, which plays a multitude of gas flames on the glass for sealing purposes, the only method by which the elements may be heated is to place them in a very intense radio-frequency field, which heats



This is the Sealex machine, which seals and exhausts the valves. The assemblies are fed by the girl at the rear into the machine, which is revolving all the time, and go round twice before they are finally completed. In the foreground, we see valves being ejected down little chute, ready for basing and capping. The heating of the glass in this machine is done by gas. As it revolves, the gas flames play on the glass parts to be heated, increasing in intensity asthe machine revolves. The exact heating effect of the glass is worked out before hand, so that it becomes just so hot, and no hotter. Naturally, very careful control of gas pressure is needed to control this. At the extreme left, the valves may be seen in the centre of heavy copper coils. These are connected to the high power oscillator, and are used in driving out gases and firing the "getter."

This is the stem machine, also operated with gas flames. In this machine, the comparatively heavy upright wires are fixed into the pinch, together with the glass tube which is later used to exhaust the valve. When these stems are completed, they pass to the mounting bench, where the various grids, plates, and filaments are assembled to make the "works" complete.

em by virtue of the R.F. currents in-ced by the field. So a special oscilla-, similar in power to a small broad-sting station, is hitched to the achine, and each valve automatically os into the centre of the coils attached the transmitter, when the time for ating arrives. When the "getter" is ady to be fired inside the valve the sembly dips down just a little further, that the active material in the bulb heated by the R.F. field sufficiently r it to ignite.

All this is done while the operatives ed glass bulbs and assemblies into one d of the "Sealex," and collect them, l cooled down at the correctly graded te, at the other end.

AS REGULATION

Some very interesting points arise a machine of this kind, which must be carefully watched if it is to be successful.

It is obvious from the beginning that the whole success or failure depends on a constant gas pressure.

The gas in this and other similar machines is played on the glass stems and bulbs by means of regulated jets.

Before a batch of valves is sent through, the machine is set up, and the intensity of each jet adjusted so that the glass is heated progressively as it moves on its way.

So carefully are these jets graded that in one machine a piece of tubing is heated as it revolves, just so much that the bottom section drops off under its own weight.

Naturally, such fine limits would not be possible without the very greatest accuracy in adjusting the gas flames, for too little would mean that the tube would be carried on with the bottom section still attached, and too much would possibly overheat the glass, and again cause trouble.

So a special gas regulator is included in the equipment, the purpose of which is to maintain a steady pressure of gas, irrespective of the varying load on the mains serving the surrounding district.

COOLING THE GLASS

Not only has the glass to be heated by gas, but cooled also. After the critical temperature has been reached for each operation involving heat, the glass must be annealed again as it cools down.

Just as the gas flames were carefully graded in the heating process, so that the rise in temperature was gradual, so are they graded to cool the glass as it comes off the machine.

The actual operation to be carried out on the glass may occupy only a few feet of the valve's "run" round the machine. The rest of the time is taken up by heating and cooling the glass.

THE GLASS BULBS

As a rule, the glass bulbs are not made at the valve factory, which, after all, is not a glass factory, however much it might seem to be from the above description!

The bulbs are made elsewhere from special glass, and are scientifically shaped.

Apart from serving as a support for the inside assembly of the valve, the glass of the bulb must be able to withstand the pressure of the atmosphere from outside without collapsing.

For this reason, the shape of the bulb is scientifically worked out so that all these things are taken into consideration.

ASSEMBLY

We have so far said nothing about the task of winding the fine wire which makes up the various "grids" inside the assembly. Each of these grids is wound by a machine working under the very closest tolerances, and each turn is fixed in position by a riveting action to the wire which supports it.

The little "branches" which must be attached to these main uprights, so that the rest of the assembly may be held together, are each spot-welded by hand in the correct positions. The task of doing this automatically is rather too complex for machinery to handle, but the girl operatives are so deft in their work that they can perform the operations almost as quickly as machines.

The finished assembly is mounted in the glass "pinch" or bottom support by an automatic machine, which moulds the glass with the aid of gas flames, carefully graded in their intensity, so that the glass is heated just enough at just the right time, for the mechanical fingers to nip them together and produce a rigid assembly ready for the sealing process.

Meanwhile the glass bulbs have been prepared, sprayed with that black coating inside, placed there to ensure a uniform electrostatic charge inside the bulb, and meet the inner assembly at the "Sealex."

MICA BONDING

One reason why the valve can withstand mechanical shocks without damage is that at the top and sometimes the bottom as well the assembly is braced by a suitably shaped piece of fine mica, which in turn makes firm contact with the inside of the glass. In the older valves one could easily move the position of the inner assembly by sharply knocking the glass bulb. This cannot happen with a modern valve, which is rendered immune to such things. In most cases the glass would break before the assembly could be jolted out of place.

TESTING AND AGEING

After the valve is completed the base is attached, and then commences the careful process of "ageing" and testing. The ageing is necessary to render the valve active after its various processes, and it is so carried out that each valve of the same type has as nearly as possible the same characteristics. Unless this is the case the receivers in which they will be used would not be able to maintain a consistent performance.

So complex are the processes in valve manufacture that it is impossible to give a full description of them all without recourse to actual demonstrations. There are hundreds of other points which we have been unable to cover, particularly the construction and manufacture of filaments and cathodes. This is one of the most important of all, for on the emission from these according to the type of valve, depends the whole of its operation. Only by constant care, testing, and inspection is it possible to produce, at the rate of hundreds per hour, valves which are identical in every respect.

The valve has been called the Aladdin's Lamp of Radio. In the magic it embodies and the wonders it performs this title is well merited.

TESTING

The testing of the finished valves is a very thorough process, as there are so many things to be considered.

If you have ever seen the specification charts which are issued for each type of valve, you will have some idea of the many characteristics which are taken into account. First of all, there is the emission from the cathode or filament. This, of course, is the primary factor in the valve's performance, and must be carefully checked before anything else.

A stroll through the factory will, sooner or later, bring you to a number of huge racks, in which lines and lines of valves are plugged, all connected to a source of filament and high tension voltage.

Meters above the valves are switched in the circuit, from time to time, and the readings of each valve compared with a standard. If, after the required period of ageing time, the valve does not measure up to this standard, it is pulled out of its socket, and ruthlessly destroyed. There is a market for only one type of valve—a good one. Poor valves, the result of some little defects in materials or manufacture, which sometimes occur, are useless to anyone, and must never be allowed to leave the test rack. Another valve takes the place of the defective unit, and so the testing goes on.

This machine prepares the glass flare, which later will be pinched at the top, to serve as a mount for the wire uprights in the valve assembly. Once more, regulated gas flames heat the glass so that it can be moulded into shape.

MICROPHONICITY

What a long word for a simple thing. Sometimes a valve may show signs of a slight looseness somewhere in the assembly, which will vibrate under mechanical shocks, and set up noises in the set.

Each valve, as it undergoes its final tests, is plugged into a special amplifier connected to a loud speaker. Two little hammers are then made to strike the glass of the valve. If there is any noise in the speaker, it is a sign that some minute looseness is present, and the valve is thrown out. On the face of it, this seems a very strange and elementary test, but actually, it does try out the valve under its possible operating conditions, and, after all, that is the only test which is of any value.

PACKING

Not the least ingenious thing about the modern valve, is the manner in which it is packed into its container.

In the early days, most elaborate care had to be taken to surround the valve with soft material to absorb possible shock. Valves now are much more robust, and except in the case of transmitting types, or large receiving types, don't need quite so much of this. However, it is often necessary to test a valve before it is sold, and if it were sealed in a simple box, one would be forced to break the seal in order to get it out.

The modern valve, however, has a special carton with a double bottom. This allows the valve to be sprung downwards so that the prongs project through a hole in the end. It can now be plugged into the tester without further trouble.

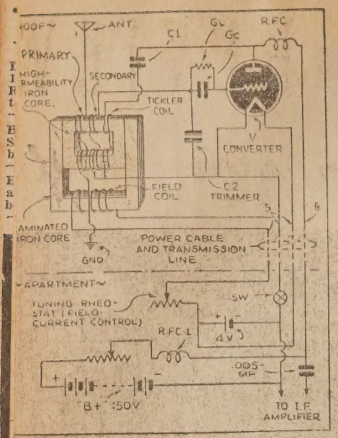


Fig. 1. Elementary converter (roof unit).

TUNING WITH A RHEOSTAT

HERE is a remote tuning control which operates perfectly without recourse to moving parts or complicated mechanical components, such as variable condensers!

The main trick of its operation consists simply of varying the strength of a small amount of direct current, and thus the inductivity of the tuning coil of a converter unit (remote-control input stage) located on the roof of the home. The purpose of locating the converter on the roof is to provide more static-free reception, especially in cities, by improving the signal noise ratio. First, by eliminating long transmission lines carrying R.F., and second, by delivering a strong, preamplified signal, at I.F., to the transmission line. These general principles have been discussed in past issues of "Radio-Craft" in connection with "centralised radio systems"; our especial interest in this article, on the other hand, lies in the novel and useful manner in which this unit on the roof may be tuned from downstairs by varying a field-coil current.

FIELD CURRENT

This current is sent through the turns of a standard A.F. choke of low resistance, of which the iron core has partly been "cut away" (see Fig. 1), leaving us, in principle, an electromagnet of U-form. Between the "poles" of our "electromagnet"—pardon me, A.F. choke (marked as unit 2 in Fig. 1), has been inserted an R.F. transformer with iron core of similar design as used at present in car-radio receivers. The primary of this R.F. transformer is connected to the antenna.

When current is sent through the turns of our "electromagnet" an electromagnetic field will be created between its "poles." The strength of this field depends of course upon the strength of the current sent through the turns of the A.F. choke. Now, let us see what happens when an R.F. coil with iron core is placed into the magnetic field of an electromagnet.

"FIELD-COIL TUNING"

Remember that stations may be tuned-in by varying *either* the capacity or the inductance of the coil, let's see what can be done if we concentrate on the latter idea.

A scheme we here utilise takes advantage of the not widely known fact that the inductance of a coil may be reduced by placing an R.F. coil with iron core into a strong magnetic field. This seems quite novel, especially since we know that many contemporary receivers are equipped with R.F. coils containing "R.F. iron" in order to INCREASE the inductance of a coil. But in our case the increase of inductance (as caused by the inserted iron core) is *neutralised* step by step by the influence of an electromagnetic field.

Or said in other words, the inductance of the coil may be decreased by the application of a separately created field, and the decrease effected may be as large as to give the coil an inductance value as large or small as it was before the iron core was inserted.

The outfit shown has been designed for the reception of ultra-short waves, received on a dipole antenna, in the range from 9.6 to 10.2 metres. The experimenter, however, may wish to utilise the principle, here described, to tune over a more limited frequency range in the broadcast band..

A close-up of the complete electromagnetic coil unit is shown in Fig. 2; at A, pictorially, and at B, by diagram.

In the ultra-shortwave autodyne circuit shown in Fig. 1, condenser C1 controls circuit oscillation. This condenser needs no further control after its initial adjustment, since the "tickler coil" as well as the "tank coil" (secondary winding) change their value of inductance in the same degree by the influence of the magnet field. Condenser C2 determines the operating range.

In Fig. 3 we see three condensers. The two added ones, C2b, C2c, are connected at will in parallel to condenser C2a by means of two relays which are operated by means of remote switches, Sw. 1a, Sw. 1b. The variable resistors, R1, R2, are connected with a separate battery in order to simplify the diagram, and are used to vary the current which is sent through the turns of the "electromagnet." Roof and apartment units are connected by a cable. The I.F. output of the roof unit is fed by means of an

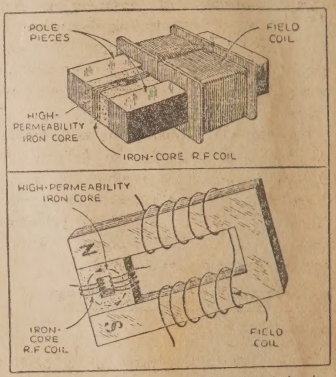


Fig. 2. Tuning by means of a rheostat involves varying a field current. The wavelength change is greatest at short wavelengths.

I.F. transformer into the remainder of the superhet. This more perfected circuit is seen to employ a full-fledged converter tube, V, in the roof unit. Considering the fact that no complicated parts are required to construct this remote control unit, one may expect that this valuable tuning method will become a great favorite with short-wave amateurs, to whom man-made static is a real bugaboo.—"Radio-Craft."

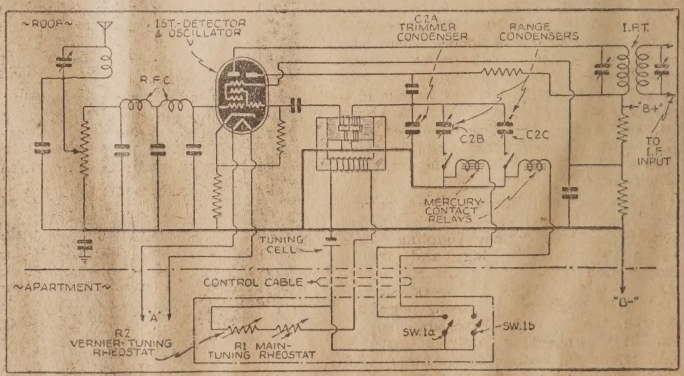


Fig. 3. Complete schematic circuit of an improved converter. This unit mounts on the roof of a home and feeds a "clean" or static-free I.F. signal into the remainder of the superhet. receiver, which is located, together with station-selecting pushbuttons and the inter-station tuning unit (a rheostat!), in a room downstairs.

EDITOR'S WORLD REVIEW

Developments in other lands

PUSH-PULL DIRECT COUPLED AMPLIFIER

WITH the present-day high development of engineering skill and manufacturing technique, it is possible to build into an amplifier an exaggerated characteristic along almost any line that one can name.

Such an accomplishment, as a matter of fact, is not merely so difficult as the designing of a product in which there is a well-balanced relation between the various aspects of performance, dependability, power output, weight, economy, and simplicity.

WHY THE "DIRECT-COUPLED" AMPLIFIER?

If the ideal attributes of a perfect amplifier were to be carefully tabulated and checked against features offered by various amplifier circuits, it would be found that a direct-coupled amplifier will fit all of the conditions and will lead, by a wide margin, the very finest resistance-coupled, impedance-coupled, or transformer-coupled units.

The advantages of Direct-coupled Amplifiers were known for a great many years, but the inability to attain a simple and practical *direct-coupled inverter, in order to achieve push-pull output and its many attendant advantages,* offered a serious handicap to the popular use of this circuit.

Although a successful direct-coupled inverter circuit was developed about two years ago, it required a special output transformer, and did not follow extreme simplicity of design. *A new circuit now removes the last objection to the popular use of the ideal direct-coupled amplifier for all applications; at the same time, ALL-PUSH-PULL operation is obtained.*

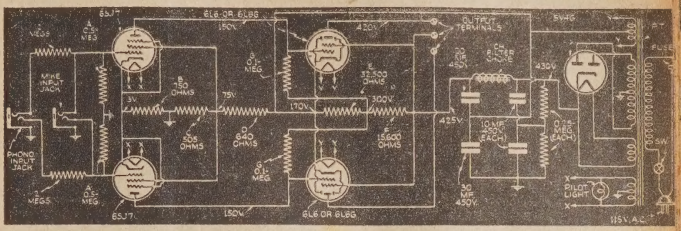
It is also well known, that *direct-coupling* overcomes objectionable characteristics of transformer coupling (core saturation, magnetic lag, and transformer resonance) and resistance coupling (short-circuiting of weak signals and grid blocking of strong signals). Furthermore, it is unsurpassable from a simplicity standpoint (only 9 resistors and the usual output transformer plus filter supply are required to attain extraordinary results!).

The question may well be raised, "If this type of a circuit is so extraordinary, why is it not more popular?" The answer is found in the usual objections offered to direct-coupled circuits, plus the fact that because of its unusual arrangements it had not received deserved attention from design engineers.

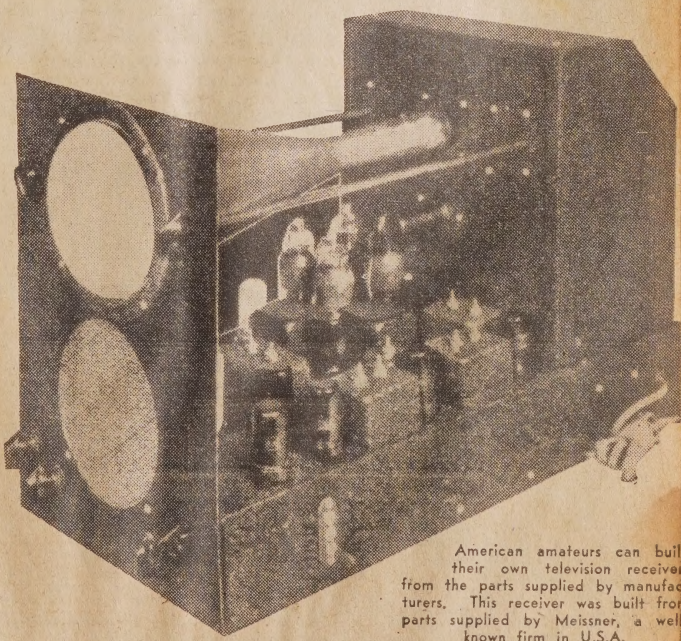
The usual objections to the direct-coupled amplifier are:—

(1) Tricky circuit.
(2) Instability.
(3) High voltages required.
(4) Critical hum-balancing adjustments necessary.
(5) Variations of characteristics similar-type tubes affect voltage distribution within the amplifier.

All of these objections have now been completely eliminated. In fact, an understanding of the design principles involved in engineering an amplifier this type will convince the greatest sceptic, that its performance, dependability, economy, and simplicity could not be surpassed.—Radio Craft.



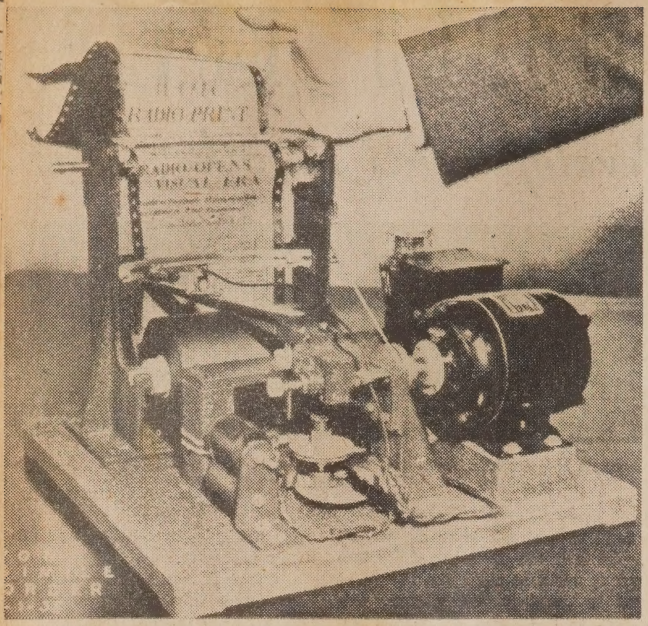
Complete Schematic diagram of the 5-tube, 10-w., All-Push-Pull Direct-Coupled Amplifier.



American amateurs can build their own television receiver from the parts supplied by manufacturers. This receiver was built from parts supplied by Meissner, a well known firm in U.S.A.

Facsimile Transmission

Pictures Via The Wire

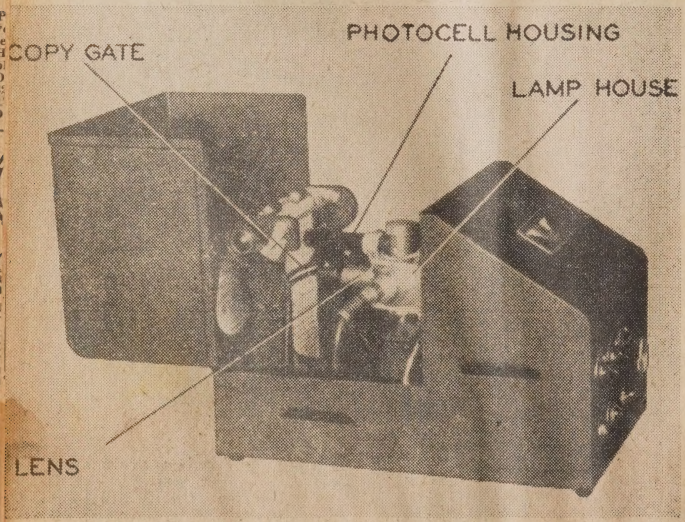


This shows in action the machine which actually prints out the facsimile as it is being received.

One phase of radio which may have a big future is that of facsimile transmission over the air. This process allows any printed matter to be transmitted as a complete page, and duplicated at the receiving end. For instance, one might receive the daily paper on a machine which operates while the family sleeps, and presents the master of the house with his duplicated news sheet right on the dot! This article gives an explanation of how one popular facsimile transmitter operates.

IN any system of facsimile transmission, the original printed matter must be analysed in elementary dots or lines. That is, the picture is traced across point to point in consecutive horizontal lines, and the density value of each point is sent over the transmitting medium. At the receiving end these dots must be recorded in their proper place and be of the same density as the original.

The Finch System makes use of this general method, and the elementary dot is .01 inch in diameter. Each traced line is about four inches long, so there are about 400 dots to the line. The period of the sweep across each line is one half-second, so the rate of change is in the order of 800 dots per second. Accordingly, for each second of time a line .01 inch in thickness is drawn, and the scanned copy as well as the recording paper is advanced .01 inch. In order that each dot will appear in its proper place, the mechanism must be synchronised at the start of each line.



One of the transmitting units with the cover removed. This unit may be connected to any 500 ohm line and works at a maximum level of zero decibels.

SCANNING

The scanning device is incorporated in the transmitter and consists of an 1800 r.p.m. synchronous motor, which drives by means of a 30 to 1 worm reduction gear, a shaft carrying three cams. These cams in turn take care of all the necessary mechanical motion.

The first cam operates a spring switch, which at the start of each stroke closes the circuit to the line, and also shunts a condenser across the grid circuit of an oscillator, and thus changes the frequency of the oscillator from a normal value of 2000 cycles per second to 500 cycles per second.

As the tracing arm starts the stroke

the 2000-cycle note is restored for the duration of the stroke. This same switch opens the line circuit during the return of the tracing arm.

The second cam drives the tracing arm. This arm is 5½ inches long and moves across the paper in an arc of this radius, the paper being held in position to fit the arc with a curved piece of spring metal. On the arm is a lamp housing and lens system from which a beam of light is focused on the paper in a spot .01 inch in diameter.

Also carried on the arm is a photo-electric cell into which the light from the paper is reflected. Then as the arm travels across the paper, the reflected light varies in accordance with the density of the printed matter, and this in turn varies the output of the photo cell.

The output of the photo cell is used to change the amplitude of the signal from the oscillator mentioned above. The circuit is so arranged that, when the print is black, the amplitude is the greatest, and any degree of grey causes a corresponding amplitude of signal.

THE OSCILLATOR

The oscillator employs a push-pull circuit and uses an audio transformer in the tuned circuit. Normally the output frequency is 2000 cycles per second, but can be changed to 500 cycles per second by means of a condenser across half of the grid circuit. In operation, the 500 cycles is used only for a very short while at the start of each stroke for the purpose of synchronising the scanning sweep to the recording sweep. The 2000 cycles is used in the scanning of the material, and its amplitude is controlled by the photo cell. The output of the oscillator is fed through an amplifier, and out on to the line feeding the broadcast transmitter.

The third cam operates a ratchet mechanism, which in turn advances the paper .01 inch for each sweep of the arm. The advance is made on the return stroke of the arm when no signal is on the line.

A FULL CYCLE

One complete cycle of operation can be described as follows:—As the arm starts the sweep stroke the 500-cycle note is on the line for the duration of about ten cycles, then the 2000-cycle note is on the line for the duration of the printing stroke, and the amplitude of this note varies with the density of the printing. On the completion of the printing stroke the line circuit is opened, the back stroke is started. When the stylus is approximately half-way back, the advance mechanism moves the paper up, and this vertical motion of the paper is completed by the end of the back stroke. At the completion of the back stroke the spring switch again closes the circuit to the line, and the operation is ready to be repeated. The signal is then sent either by wire or radio facility to the recorder.

THE RECORDER

The action of the recorder is very similar to the transmitter. It also consists of a synchronous motor drive, worm gear arrangement, and the same type shaft and cam mechanism. When the transmitted signal is received and amplified to the proper level, the following process takes place:—

First the signal is rectified by means of a full wave rectifier, and the rectified current is connected to one contact of a cam operated spring switch. A filter that by-passes 2000 cycles is shunted across the secondary of the transformer that feeds the rectifier, and also connected to the spring switch.

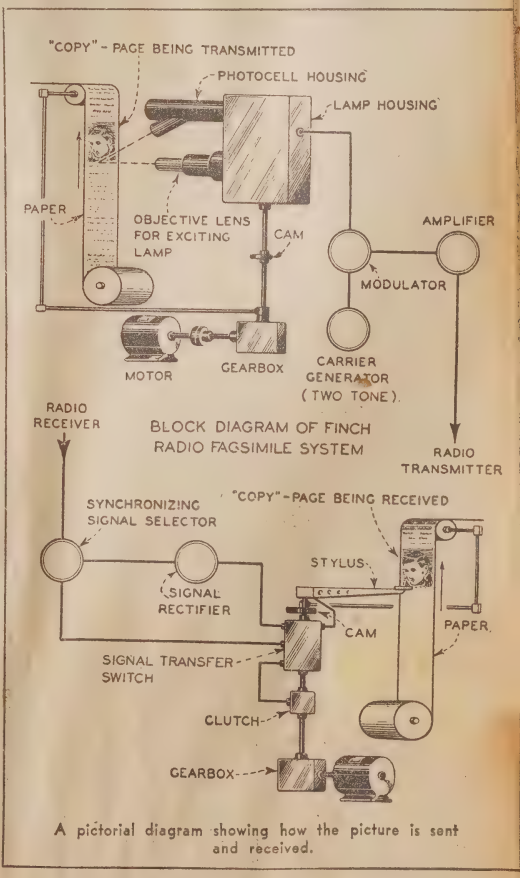
When the friction drive is locked, no 2000 cycle current is rectified, and no D.C. reaches the switch until the 500-cycle note is received. When the 500-cycle note is received and rectified, D.C. reaches the switch, and from this point is connected to a magnetic release which starts the camshaft in motion. The start of this motion opens the magnetic release circuit, removes the by-pass from the 2000-cycle circuit, and connects the recording pen in the circuit.

The 2000-cycle signal is then rectified and placed on the recording pen, the pen sweeps across the paper, and, as it does so, the intensity of the voltage on the pen is varying in accordance with the amplitude of the 2000-cycle note, with this amplitude dependent on the density of the printed matter of the original. At the end of the stroke, the signal is cut off at the transmitter and the printing stops. On the return stroke the paper is advanced in the same manner as in the transmitter. About half-way back on the return stroke the spring switch cam moves the switch to place the magnetic release in the circuit, close the by-pass circuit, and removes the pen from the circuit.

At the close of the stroke the friction drive is again held until the synchronising pulse is received, and then the act is repeated. If the recorder is runn in synchronism with the transmit the synchronising pulse will come the exact time that the friction d is released and the machine will essentially free running. If the recor leads the transmitter, the recorder be synchronised at the beginning each stroke. If the recorder lags hind the transmitter, the recorder fall out of synchronism entirely.

The action of the actual printing electro-chemical; when the rectifi voltage is supplied to the pen, it con in contact with a coated carbon i pregnated paper, the current throu the paper is a function of the appl voltage, and the consequent removal the surface coating is also a functi of the applied voltage. The voltage of course, dependent on the amplitu of the 2000-cycle signal, which is turn dependent on the density of t printed matter.

The Finch system fulfils the requir ments outlined in the first paragra in that the elementary dot is in t correct time position and of the prop depth of print to give a faithful repr duction of the original print.



A pictorial diagram showing how the picture is sent and received.

THE BAND-BOX SINGLE-UNIT RECEIVER AND TRANSMITTER

LLOYD V. BRODERSON, W6CLV

s excellent little transmitter-eiver should contain some as particularly for the new amateur.

HE mention of a combined receiver and transmitter without benefit of shielding usually will bring to mind problems of feed-back, interpling, and r.f. pickup. These factors of major importance in the design high-power equipment, but present difficulties in the construction of -power units. For all practical purses a transmitter of comparatively power may be mounted upon the ne chassis as the receiver, and each t still give good account of itself. he unit here described may be conicted with ordinary woodworking ls; no metal work is involved. Chassis ports and cabinet are of soft pine d all panelling is of masonite. Inced r.f. due to adjacent pickup is so all as to be negligible. The receiver an efficient performer; the transmithas reasonable power output (nor-l input, 22 watts) and the entire unit operated from a single power supply. mplete, it weighs but 14lb.—a disct advantage should portable operan be contemplated.

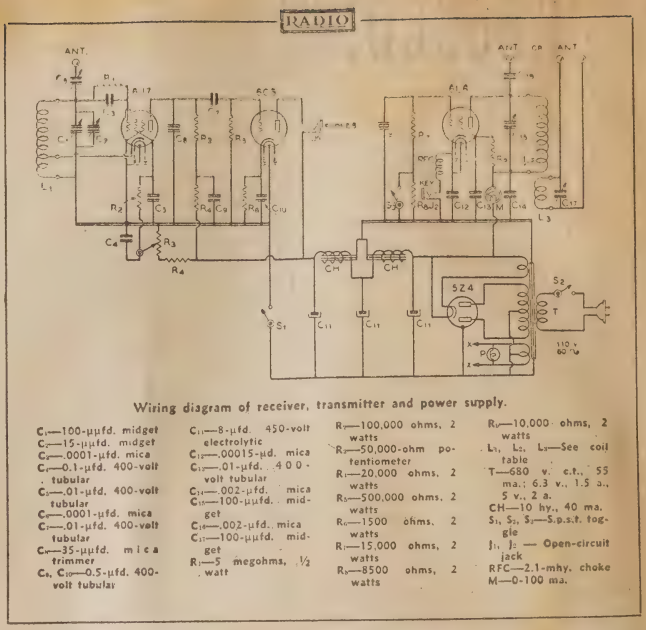
CEIVER CIRCUIT

The receiver section is simplicity itf. A 6J7 detector with cathode reneration is resistance coupled to a 5 audio stage. It is a tried and oven circuit and retains some excelit features even in this day of more borately designed receivers. Should e builder so desire, the 500,000-ohm ed resistor in the grid of the audio age may be replaced by a midget-type lume control. This may be mounted the front panel wherever convenient.

RANSMITTER CIRCUIT

The transmitter portion consists of a 6 (metal type) regenerative crystal osllator with provision for fundamental d harmonic operation. Relatively high fficiency with low r.f. crystal current nd its ability to be heavily loaded are s outstanding characteristics. No oublesome keying problems will be enountered and the usual attendant bugs" have been quite conspicuous by eir absence.

A glance at the power supply portion nows no radical departure from cusmary practice. Two filter chokes comined with three 8mfd. filter condensers dequately filter the d.c. The transmitter positive terminal is taken directly from the rectifier filament, thereby enabling the full rectified output to be applied to the plate of the 6L6 tube. A single-pole switch in the negative lead disconnects the receiver during transmission periods. It may, however, be left closed should break-in operation be desired.



Wiring diagram of receiver, transmitter and power supply.

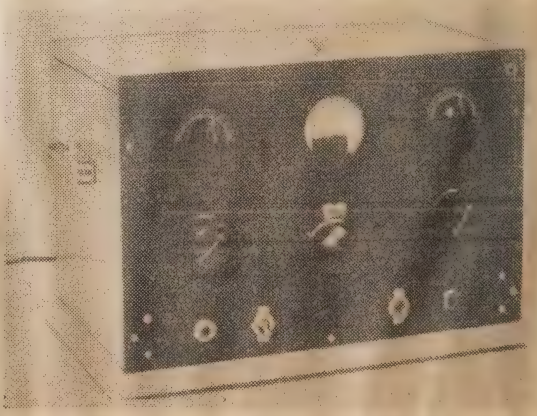
C_1—100-μμfd. midget
C_2—15-μμfd. midget
C_3—.0001-μfd. mica
C_4—0.1-μfd. 400-volt tubular
C_5—.01-μfd. 400-volt tubular
C_6—.0001-μfd. mica
C_7—.01-μfd. 400-volt tubular
C_8—35-μμfd. mica trimmer
C_9, C_{10}—0.5-μfd. 400-volt tubular
C_{11}—8-μfd. 450-volt electrolytic
C_{12}—.00015-μd. mica
C_{13}—.01-μfd. 400-volt tubular
C_{14}—.002-μfd. mica
C_{15}—100-μμfd. mica
C_{16}—.002-μfd. mica
C_{17}—100-μμfd. midget
R_1—5 megohms, ½ watt
R_2—100,000 ohms, 2 watts
R_3—50,000-ohm potentiometer
R_4—20,000 ohms, 2 watts
R_5—500,000 ohms, 2 watts
R_6—1500 ohms, 2 watts
R_7—15,000 ohms, 2 watts
R_8—8500 ohms, 2 watts
R_9—10,000 ohms, 2 watts
L_1, L_2, L_3—See coil table
T—680 v. c.t., 55 ma.; 6.3 v., 1.5 a.; 5 v., 2 a.
CH—10 hy., 40 ma.
S_1, S_2, S_3—S.p.s.t. toggle
J_1, J_2 — Open-circuit jack
RFC—2.1-mhy. choke
M—0-100 ma.

CONSTRUCTION

The layout diagrams and photographs clearly show the location of all components above the chassis. The front panel is finished in black crackle and holds the following controls:—From left to right at the top portion are the regeneration control, transmitter plate miliammeter and transmitter antenna coupling condenser. A band-set condenser and the vernier tuning and plate tank condensers occupy the centre portion. The lower panel space is occupied by a phone jack, negative lead switch, and pilot light.—"Radio."

POWER SUPPLY

The transformer specified delivers 680 volts centre tapped at 55 ma. In addition there is a 5-volt 2-ampere winding and a 6.3-volt, 1.5-ampere winding. Any transformer having the above ratings may be used if it is borne in mind that the 6.3-volt winding furnishes heater current to all tubes except the rectifier and therefore should not be rated at less than 1.5-amps. A 20-watt, 25,000 ohm bleeder resistor may be incorporated, if desired, purely as a precautionary measure. However, the filter condensers operate well within their ratings and the bleeder really is not necessary.

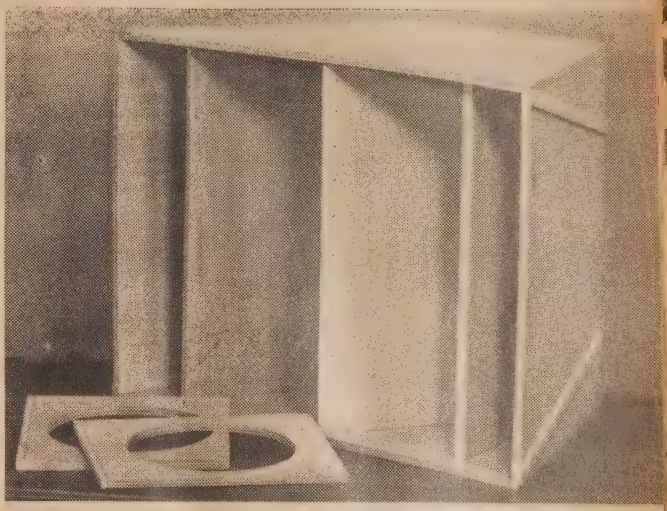


This picture shows the compact cabinet used. It measures 13 inches, 8 inches high, and 9 inches deep.

STEREOSCOPIC IDEA FROM AMERICA

USING TWO RADIO SETS

About a year ago, the Technical Editor evolved a system of Stereoscopic reproduction using two speaker units, one for the high and middle registers, and another for the middle and low registers.



The low frequency loading horn employed by our own scheme. Two speakers are used in this horn.

THE following extract from the latest "Science Digest" has a particular interest in that exactly the same principle is involved.

Most people who have bought an improved radio junk their old one. That is not always wise.

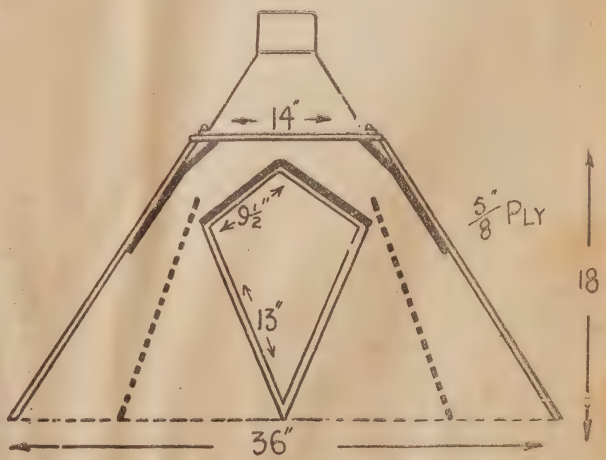
First find out whether your old radio amplifies better the low or the high pitches prevailing in music. Then adjust your new radio, which often permits it, so that the other pitches are favored by its amplification. Now, if you have a very large room, put one radio in one corner and the other in the diagonal corner, and seat yourself near the middle. If you have only small rooms, choose two with a connecting door open, place your radios as far apart as possible, and seat yourself near the door in the larger of the two rooms.

A little experimenting may be called for. You will more or less readily observe a strange effect. Close your eyes or simply forget what you actually see with them. It seems that you have before you the orchestra with the musicians so seated that the highest pitched instruments are on one side of the stage, the lowest pitched on the other side, and the middle instruments ranged between accordingly.

If it is a mixed chorus you are listening to, the female singers seem to be on one side of the stage, the male singers on the other side. Or if it is a duet of a soprano and a basso of the Metropolitan Opera, you seem to be located between the woman and the man. In some cases, though, the peculiar voice quality of the basso singer may diminish the strength of this spatial illusion by "splitting," so to speak, the basso's voice into a lower and an upper component. It goes without saying that you can have the effect only if you have two fairly good ears. If you are deaf or hard of hearing in one of your ears, you will try in vain.

As soon as you begin to differently **localise** the higher and lower sounds, you notice that the ease with which you **analyse** the compound sound is enhanced, the keeping apart of the components of any chord is a matter of less effort to your attention. The ability to analyse, to overcome the fusion to which the simultaneous tones are subject in the untrained listener, is one of the greatest assets for the appreciation of our modern highly complex music.

Max F. Meyer, University of Miami, "Science."



The dimensions of this horn are often requested of us. We reproduce here the original drawing. The height of the horn is 30 inches.

If this lovely picture of cloud, sea, and sail, could be shown in colors, what would be the wavelength of each?

WHAT WAVELENGTH IS COLOR?

In the amazing co-relation between the universe and vibrations, color is just another example. Is there such a thing as color? Let this article help you to understand it.

By... CALVIN WALTERS

HERE is one thing about these scientific discoverers that makes my hair stand on end, and that is the way they have of describing most beautiful effects in Nature in most uninteresting terms.

Take colors, for instance. When I ss around the garden I like to think that plant that the grubs happened miss as having red flowers. Or the as blue, or that most sought after elusive object, the pound note, as en.

OLORS AND WAVELENGTHS

Yet a scientist goes and talks of them wavelengths. He is perfectly right, nd you, yet it does sound a bit unpiring, doesn't

Fancy going o a mercer's a necktie d saying you nt one of ch and such wavelength. ien, when you t it home, you found it was fraction of an inch out in length, nich made it a different color altother. Wouldn't it sound thrilling to y that a person got such a fright that s face went so many millimetres wavegth, or a blushing girl's face was a vid ten thousand millimetres!

However, there it is, and nothing on earth can stop them. Of course, it does explain a lot, and is very handy when we want to know why red is red and blue is blue.

It is a fact that objects do not possess any fixed color of their own. There are about 1000 colors that the eye can distinguish. It is more correct to say HUES, for a tint is also a color, and there are 2,000,000 odd of them. A tint is a variation of a hue.

Light waves in general are waves in the ether of a certain length, and it is the effect they produce on the optic nerve that determines whether our brain will translate them in terms of any particular color.

Every disturbance in the ether is some kind of wave. About the longest are sound waves. Then we come down through electro - magnetic waves, which are the waves that we receive from the wireless station. Then the waves become shorter and shorter to visible light rays to heat or infra red, and so on to color through red, orange, yellow, green, blue, indigo, violet, ultra-violet, to X-rays, &c.

As I said above, objects do not possess a certain color of their own. They depend for the color on their ability to absorb certain of the color waves and reflect others. If, for instance, the table cloth is green, it means that the cloth, or the material of which the dye is composed, absorbs all the light waves but green This green ray is reflected to the eye, where it is transmitted to the brain and the brain does the rest.

DOES COLOR EXIST?

Actually no color in any object exists at all, unless the object is illuminated with some sort of light. If the light is a pure white light like bright sunlight this light contains within itself all the fundamental colors—violet, indigo, blue, green, yellow, orange, and red.

So that all these colors are being transmitted on to any object within the compass of the light. If then an object is capable of reflecting ALL the color waves it will appear white. It will appear red in red light, blue in blue light and so on. On the other hand, any object which ABSORBS all the color waves will appear black in any colored light at all.

If part of all the color rays are reflected and part absorbed the object will be grey.

An unconscious act which we all perform and about one in a thousand ever stop to think why, is that of taking a piece of, say, dress material into the daylight in order to see what its true color is. We know that it appears a different color under the artificial light of the shop. The reason for this should

be at once clear in view of what I said above about the colors of objects in various colored lights. The light from artificial light is rarely pure white, containing usually a predominance of some particular color rays. If the dress material is green and the artificial light contains a predominance of red rays, the final color will be a sort of black, because there will not be sufficient green rays from the light to reflect to the eye. So we go into the sunlight, which contains ALL the colors, and we get a true estimate of the color of the material.

Have you noticed the effect that those new mercury vapor street lamps give? The general effect when one sees another person in the light of these lamps is one of extreme ghastliness. All the colors of every object seem to be changed except blues, and the person's face looks as though he has had bad news from home or his bookmaker. The reason, of course, lies in the predominance of blue rays from the lamp.

Flowers are red, yellow, or blue, according to their ability to absorb or reflect certain of the rays. Some flowers are multi-colored, which seem to show that part of the flower must be different to other parts. This will be found to be true if the flower is examined under a microscope. The texture of the petals of a white and red rose is different.

CLOUDS AND COLOR

Clouds which are of different colors are more or less dense as well as being differently placed with regard to the eye of the spectator. But they all depend on the light of the sun for their colors. If you cover a plant it will soon become of a white, pale color. The texture of the leaves and petals also changes.

Transparent objects are colored by their ability to screen out certain rays. Green glass is only green because green rays pass through it. This fact is made wide use of in photography. If, for instance, it is required to take a photograph of a colored object, and certain of the colors would have some adverse effect on the photographic plate, a transparent colored glass is placed in front of the lense. This glass is chosen according to its ability to screen out certain of the unwanted color rays.

COLOR PRINTING

The blocks from which a colored picture in a magazine is printed are made under this principle. ALL colors can be produced from a combination of red, yellow, and blue, which are called primary colors. To make a block from a colored picture, the picture is placed before a camera with special transparent color filters arranged before the lens. This filter has the effect of excluding, say, the red rays. The other rays have an effect on the film in the camera, and by a process of elimination, using color screens, photographic films are made of the red, yellow, and blue in the picture. These films are transferred to metal, and the metal is etched, producing a block for each of the red, yellow, and blue parts of the picture.

In the printing process, say, purple will be produced by a combination of the blue and red. Green, by mixing yellow and blue; and so on through the full range of colors.

Colors vary in "hue." Hue is the difference between, say, green and yellow. Colors of the same hue vary in "value," that is, they are bright red, light red, &c. This is due to the amount of the light reflected.

Adding white to hues forms "tints." Adding black forms "shades."

Of all the colors in nature, blue seems to be predominant. And this blue, or some of it, appears an exception in the way in which it is produced. If you watch smoke rising from a cigar, or any other kind of gasper, and most other kinds of fires, in bright sunshine, you will notice that it has a blue tint. But if you look at it when it is between the sun and your eyes it will have a reddish brown tint. Also, when the smoke has been in the smoker's mouth for a few seconds it is no longer blue when looked at under any conditions. It is opaque white. This is due to the cooling of the smoke, which increases the size of the particles. The larger particles reflect white light. A cloud formed of the finest particles gives the strongest blue from reflected light. The blue color of the sky is caused by the reflection of light from the finest particles of water vapor floating in the atmosphere, NOT from the absorption of all the other colors.

If your milkman turns the tap into your milk the milk always has a bluish tinge. This is caused in the same way. It looks blue owing to the fine colorless particles suspended in it, which act on the light in the same way as smoke.

Those big blue eyes of your favorite girl or child or film star, or what have you, are produced in the same way. The light is reflected from fine particles in the translucent tissues of the iris over the black chamber of the eye.

These are cases where the substance acts on the light, not the light on the substance.

Some animals and birds having blue in the skin or feathers have this blue produced in the same way. The skin

(Continued on Page 75.)

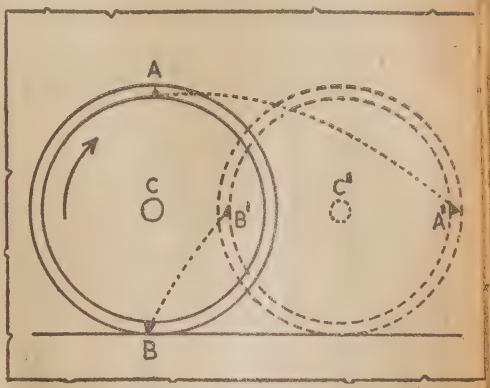
WHICH PART OF A WHEEL GOES QUICKEST

At first thought it would seem impossible for one part of a wheel to travel at a different speed from another part, since the wheel is all in one piece.

HOWEVER, that a difference of speed really exists seems to be indicated by the fact that photographers who try to catch a portrait of a moving vehicle with spoked wheels find that when the exposure is so timed as to show the bottom spokes clearly stopped, the top spokes are blurred, showing that they were travelling at a higher rate of speed.

The solution to this apparent paradox lies in taking into consideration the fact that the wheel has two motions—it revolves on its axle, and it also moves forward relative to a stationary observer.

It is the forward motion through space which causes a point at the top of a wheel to move momentarily faster than one at the bottom.



In the accompanying diagram, A is a point on the top of a wheel, B a point on the bottom, and C is the centre or hub of the wheel. The dotted circle represents the position of the wheel after it has rolled forward one fourth of a revolution, A1, B1, and C1 indicate the new positions of the three points.

A little study of the length of the paths traversed by the three points will show that point A travels farther, and consequently faster, than point B.

Point C moves forward in a straight line from C to C1. Point A moves in a long arc from A to A1, while point B moves in but a short arc from B to B1. This is because, during the quarter revolution under consideration, point A is travelling forward relative to point C, its axle, and that movement is added to and increases the velocity of point A as the whole wheel moves forward.

Point B, on the contrary, has a motion relative to C which is backward, and is consequently subtracted from the forward motion of the wheel.—W. P. Keasbey.

An elementary

COURSE IN RADIO

for beginners

Being a very elementary course of Radio study for those who wish to know "what makes the wheels go round."

By L. B. GRAHAM, Principal of the Australian Radio College, Pty.,

TUNING COILS for RADIO RECEIVERS

OILS are generally used in radio receivers in conjunction with tuning condensers for the purpose of selecting the station which desires to hear, and also for pling two sections of the set together. example, coils are generally used for pling the signals from the aerial to crystal detector or first tube, and large sets they are used for coupling output or plate circuit of each tube ndling high frequency signals, to input or grid circuit of the follow- tube.

OPPER WIRE

Most coils consist of two separate ndings of copper wire wound on a indrical former made of some high ality insulating material. Signals are d into the smaller of the two wind- gs which is known as the "primary." the alternating signal currents flow rough the turns of the primary wind- g they set up invisible magnetic lines force, which spread out from and ll back into the primary in step with e rises and falls of current flowing rough it.

Some of the lines of force from the primary pass through the turns of the larger coil or "secondary," and in doing so produce a signal voltage in this winding. This effect is known as coupling, and is illustrated in Fig. 1. The secondary voltage is usually stronger than the actual voltage applied to the primary, due to the fact that the secondary has more turns than the primary.

Some coils have an additional small winding known as a "tickler" or "reaction" winding, but these coils will be described later.

The number of turns on the primary winding or tickler winding will depend on the number of turns on the secondary, as there is a definite ratio between the two. Thus the first step in designing a coil is to determine the number of secondary turns.

INDUCTANCE

The property of a coil is known as its "inductance." The unit in which inductance is measured in the "henry." Coils which handle radio frequency currents in a receiver have an inductance of a very small fraction of a henry, and for measuring the inductance of these coils a unit known as the "microhenry" is generally used. One microhenry is one-millionth part of one henry.

The amount of inductance required in the secondary winding of a coil depends on the capacity of the tuning condenser to which it is connected, and to the frequencies to which the receiver has to tune. Most receivers are designed to tune in any station on the broadcast band, and must tune from 550 kilocycles when the condenser plates are turned fully in to 1500 kc when the plates are almost fully out. Fig. 2 shows the coil and condenser connected together.

To determine the necessary number of microhenries inductance for a coil to tune to 550 kc with a certain sized condenser, it is necessary to divide the number of micro-microfarads capacity of the condenser into a number known as "oscillation constant." The oscillation constant for 550 kc is 83,730.

Two of the most commonly used types of condensers have capacities of 385 m.mfd. and 410 m.mfd. Each of these will require a slightly different sized coil. Dividing 385 into 83,730, we find that the correct inductances for this size of condenser is 217 microhenries, but to allow a little margin we would probably use an inductance of 220 or 225 microhenries. The inductance for the condenser with a capacity of 410 mfds. works out to be 204 microhenries, but we would probably use a 210 microhenry coil.

If the correct size of coil is used, we will find that when the condenser's plates are turned almost fully into mesh, its reactance is equal to and exactly cancels the reactance of the coil at a frequency of 550 kc. This allows currents from any station broadcasting at this frequency to flow around the circuits with practically no opposition. As the tuning condenser's plates are turned further and further out, its capacity will be decreased and its reactance will neutralise that of the coil at correspondingly higher frequencies, thus enabling stations at these higher frequencies to be received.

When the coil's and condenser's reactances neutralise one another, the

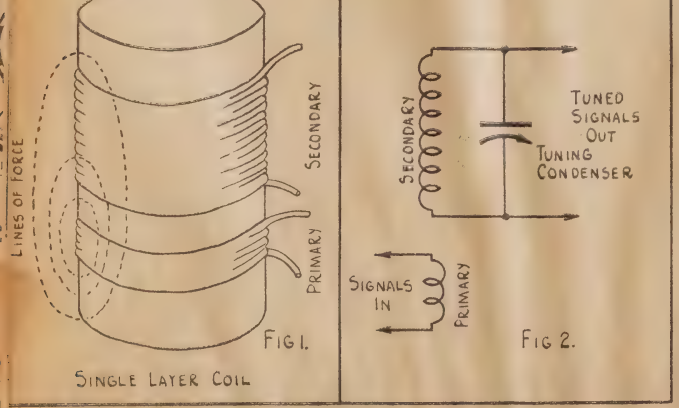


FIG 1. SINGLE LAYER COIL

FIG 2.

only remaining opposition to signal currents of the desired station is the resistance of the wires, connections and other parts. Most of the resistance is in the coil itself, and it is necessary to keep this resistance as low as possible.

Currents from other stations, which it is not desired to hear, will not be able to flow at all strongly in the oscillatory circuits, because the reactances of the coil and condenser will not be equal to one another at these other frequencies. Instead of the reactances neutralising one another, some reactance will be left to add its effect to the resistance and strongly oppose these signals.

AN EXAMPLE

Let us take a practical example. Supposing we wish to tune in a station operating on 600 ks. with the 210 microhenry coil and 410 mfd. or .00041 mfd. condenser mentioned previously. We will assume that the resistance of the circuit is 10 ohms. The reactance of the coil at 600 kc. will be approximately 800 ohms. In tuning in the station we will turn the plates of the tuning condenser out of mesh until its reactance is also 800 ohms at 600 kc. The two reactances being of an opposite type will exactly neutralise one another, so that there will be no reactance left to oppose the flow of signal currents from the 600 kc. station; the only remaining opposition being the 10 ohms of resistance.

If there is another powerful station operating on, say, 700 kc., we will not hear this as the coil's reactance will have increased to almost 930 ohms, while the condenser's reactance will have decreased to about 685 ohms. These will cancel to a certain extent, but there will still be 930-685 or 245 ohms reactance in addition to the 10 ohms resistance to oppose the flow of signal currents from this undesired station.

The ability of a tuned circuit to pick out the one desired station and reject others is determined by keeping the resistance as low as possible compared with the reactance. From this we can see that the selectivity of a tuned circuit can be improved either by increasing the reactance of both coil and condenser or by decreasing the resistance. It is not an easy matter to increase the reactance of the coil and condenser, for condensers are only made in certain standard sizes, so that the best way of improving the performance is by reducing the resistance to the lowest possible value.

THE "Q" FACTOR

The efficiency of a coil or complete tuned circuit is often expressed in a value known as its "Q factor." The "Q" of a coil equals its reactance divided by its resistance, so that the lower the resistance the higher the "Q" and the better the selectivity and sensitivity of the complete receiver. The "Q" of the tuned circuit mentioned previously at 600 kc. would be 800—10, or 80.

The resistance of a coil depends not only on the ordinary resistance of the wire itself, but on any other effects and losses which occur when the high frequency currents are flowing through it.

The older types of coils consisted of a single layer of ordinary copper wire wound on a tube of specially treated paper about 1¼in. or more in diameter and about 2in. long. These coils were fairly large and the cans used for shielding them were not very much larger, so that the space around the coil was not very large compared with the coil's size.

The resistance to high frequency currents of modern coils has been decreased and their performance improved by winding the secondaries with special wire, by using a former of high-grade insulating material, and by winding them in such a way that their size is reduced considerably, thus increasing the proportion of space around the coil to its size.

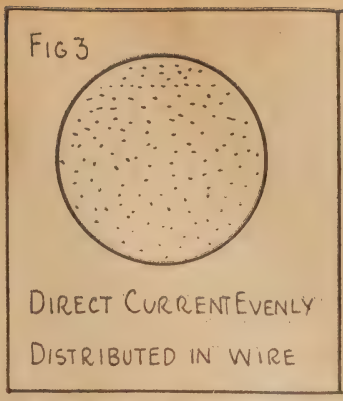
When direct current is flowing through a wire it travels evenly through the whole of the wire, as shown in Figure 3, but when high frequency current flows through a wire it flows mainly near the surface and very little flows near the centre of the wire. To reduce the resistance to H.F. current as much as possible special litz wire is often used for modern coils. This wire usually consists of 5, 7, 9, or 11 strands of very thin insulated wire, all twisted together and wrapped with an outer covering of silk. These strands of thin wire will have a greater amount of surface than a single strand of thicker wire, with the result that it has less resistance to the high frequency currents. A section through a piece of litz wire consisting of five strands is shown in Figure 5.

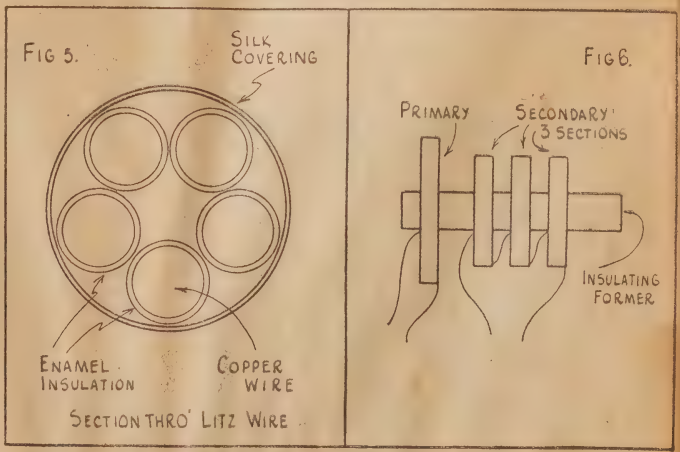
Another reduction in resistance results when the coil is wound on a material which is an extremely good electric insulator, such as first-grade bakelite or a new material which is now becoming popular, known as "Trolitule." This last material has extremely low losses.

Coils are made smaller in size by winding them in two or three sections or "pies," each section consisting of several layers wound in a criss-cross manner. This method of construction is shown in Fig. 6, and not only reduces the size, but also keeps any distributed capacity between the turns to a very low value.

By using a certain amount of a substance containing very finely powdered iron inside the windings it is possible to obtain a certain amount of inductance with less turns of wire. With less wire used there will be less resistance and further improvement in performance.

The improvements in coil construction outlined above are one of the contributing factors in the high standard of performance of modern receivers.





SOUND DIFFUSERS IN LOUD SPEAKERS

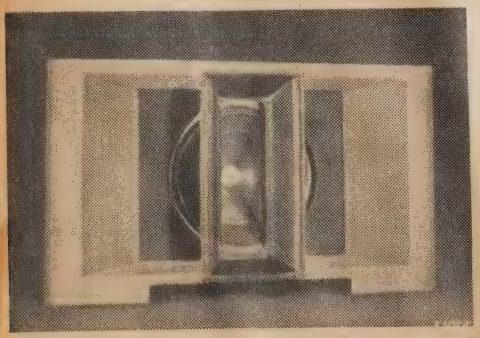
Loud speakers have the tendency to exhibit a certain directional effect which becomes more pronounced with increasing frequency. Where such a beam formation of the high tones is undesired, i.e., in small rooms, the directional effect can be neutralised by means of sound diffusers. These are bodies of definite shape and dimensions which are placed in the path of the sound waves. The required diameter of a sphere to be used as a sound diffuser can be derived theoretically. In the loud speakers of the Philips radio sets a cone and vertical partitions in front of the cone of the loud speaker are used as sound diffusers. The most suitable form and dimensions of these sound diffusers for scattering sound are determined experimentally.

BY J. de BOER

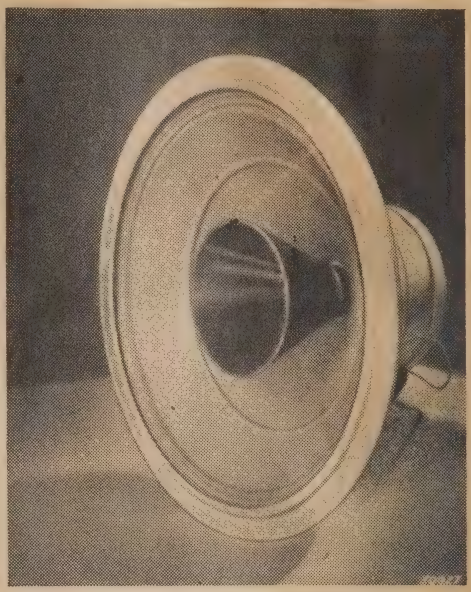
(Reprinted from Philips Tech. Review)

When sound amplification is used in halls which have a long a reverberation time, an improvement of the acoustics of the hall can often be obained by making use of loud speakers with a directional effect(a). If these loud speakers are directed toward the part of the hall occupied by the audience, the sound intensity is there increased without an amplification of the reverberation necessarily also occurring.

Aside from such special cases, however, a directional effect is generally not desired with loud speakers. This is particularly true in the case of the loud speaker in the home. In this case the listener does not wish the fact of his listening or not listening to the radio to determine the place where he shall sit, but he wishes to be able to hear the programme equally well from any spot in the room. Every loud speaker has a certain natural directional effect. In the following we shall discuss the extent to which this effect may be disturbing, and how it is possible to neutralize such a disturbing directional effect.



Loud speaker with partitions in front of the cone to diffuse sound.



Loud speaker with conical sound diffusers.

THE DIRECTIONAL EFFECT OF LOUD SPEAKERS

The appearance of a directional effect in sound radiation means that the distribution of intensity of the sound waves emitted deviates from spherical symmetry. The form of the distribution of the intensity of the sound wave depends upon the shape, the position and the dimensions of the radiating body. The loud speaker of a receiving set may for our purpose be considered by approximation to be a circular vibrating membrane placed in an infinitely large baffle board. The sound waves radiated from this source are spherically symmetrical only when the dimensions of the membrane are small compared with the wave length. When this is not the case the sound is radiated mainly in a single direction, perpendicular to the radiating membrane.

For the case in which the membrane vibrates as a whole (this condition is satisfied at frequencies which are not too high), the sound distribution can be exactly calculated. It is found that the only parameter is the quotient a/λ, in which a is the radius of the membrane and λ the wave length of the sound. *Fig. 1* shows the calculated distribution of intensity for different values of the parameter a/λ. It may be seen that for

$$2\pi a/\lambda < \text{about } 2$$

the waves are practically spherically symmetrical, while for $2\pi a/\lambda > 2$ a more and more pronounced beam formation of the waves takes place. With an ordinary radio loud speaker the vibrating surface (the cone) has a radius $a = 10$ to 12 cm. The limiting value of the parameter mentioned corresponds in this case to a wave length of about 35 cm, *i.e.*, a frequency of 1000 c/s. Tones of lower frequency are radiated by the loud speaker uniformly in all directions, tones of higher frequencies are, however, radiated mainly in the direction of the axis of the cone(b).

This quite universal phenomenon of sound radiation, that the low tones lack a tendency to form a beam, while the high tones show such a tendency, makes itself felt as a difficulty not only when the directional effect is deliber-

ately sought, but also when it is undesired. For the case mentioned in the introduction, where a directional effect of the loud speakers was desired for the purpose of avoiding reverberation in a hall, it is quite difficult to obtain a satisfactory beam formation of the low tones. Without special precautions the result may be that the non-directed part of the sound still causes a disturbing reverberation. On the other hand in the case where a directional effect is not desired, as in the living room of a private house, the problem is to avoid beam formation especially of the high tones. Such beam formation by the high tones has as

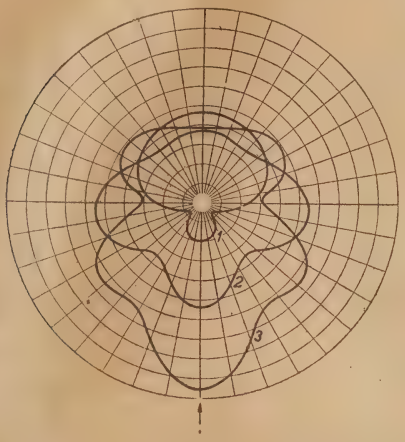


Fig. 3. Directional distribution of the sound pressure (measured at the surface of the sphere) of the wave scattered by a sphere according to Stenzel. The sound pressure (measured at the sphere) of the plane wave incident on the direction of the arrow is set equal to unity. The scattering is determined by the parameter, b/λ, whose value multiplied by 2π is indicated for each curve. At $2\pi\ b/\lambda = 2$ good scattering is obtained, at $2\pi\ b/\lambda = 3$ strong reflection already takes place.

result that the quality of the sound radiated to the sides becomes too dull and the sound directly in front of the apparatus too sharp, and that the latter sound suffers relatively more from background noise and interferences. The contribution of these extra sounds is namely the greatest at high frequencies.

THE NEUTRALIZATION OF THE DIRECTIONAL EFFECT

How can beam formation with the high tones be avoided?[c] One possibility would be the reduction in size of the radiating surface, which would make the limiting frequency for the occurrence of the directional effect ($2\pi\ a/\lambda = 2$) higher. However, in order to obtain the desired volume of sound, even in the lower tones, with a smaller loud speaker, the membrane must be given very

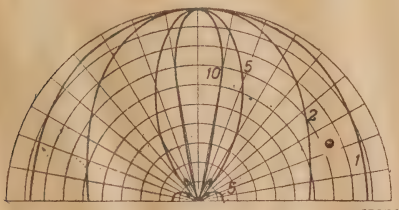


Fig. 1. Calculated directional distribution of the intensity of sound waves generated by a circular membrane vibrating as a whole in an infinitely large baffle board. The distribution is determined by a single parameter a/λ (a = radius of the membrane, λ = wave length), whose value multiplied by 2π is indicated for each curve.

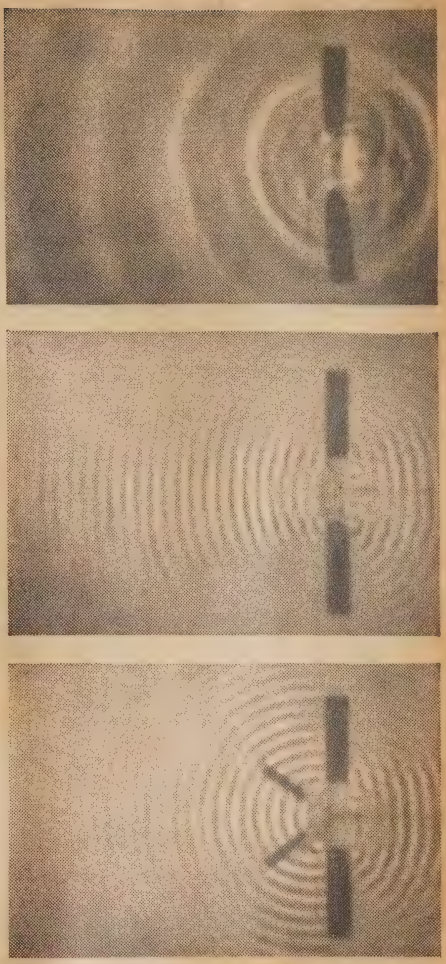


Fig. 2.—Experiments with a ripple tank to illustrate the occurrence of a directional effect at high frequencies and the neutralisation of this effect by means of sound diffusers.
(a) The relation between "source of sound" and wavelength is the same as in a loud speaker emitting a tone of 1000 c/s; the sound intensity is the same in all directions.
(b) The equivalent frequency is in this case 7000 c/s instead of 1000; the sound forms a beam in a single direction.
(c) Like (b); the beam formation is neutralised by two sound diffusers.

great amplitudes at low frequencies, which leads to distortion.

A very satisfactory solution of this problem of neutralizing the beam formation is obtained by placing in the path of the sound waves emitted a body which serves to scatter the waves. The effect of such a sound diffuser is illustrated in *fig. 2*, which represents tests carried out with a ripple tank[d]. Figs. *2a* and *b* show that with long wavelengths the "radiation" is spherical, and with short wavelengths directed. In fig. *2c* two "sound diffusers" have been introduced into the path of the directed radiation, and it may be seen that instead of directed waves practically spherically symmetrical waves are again radiated.

It is easily understood that the dimensions of the scattering body must have a definite relation to the wave length λ of the sound to be scattered. If the dimensions are very small with respect to λ, the body has no effect on the propagation of the waves; if the dimensions are very large with respect to λ, a directional reflection of the waves

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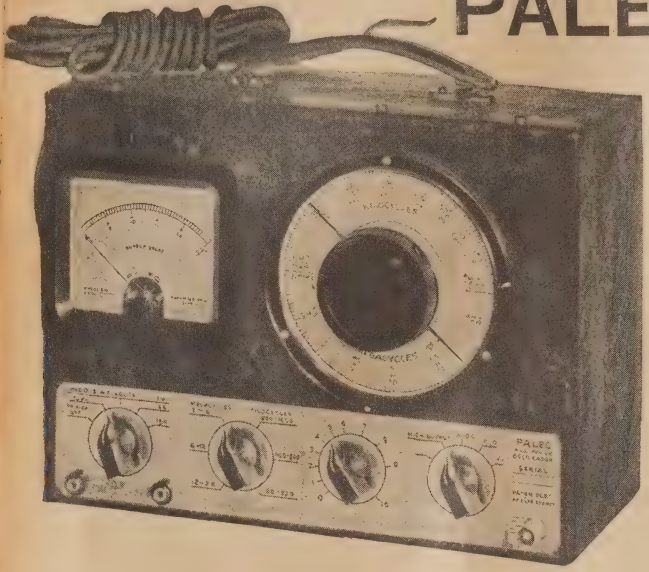

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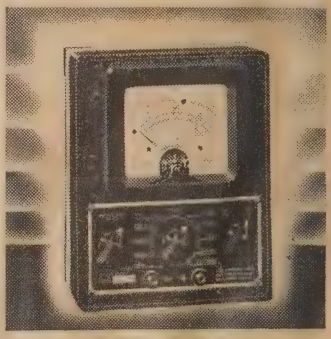

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occurs, so that the direction of the radiation is changed while the beam form is retained. The case in which a sphere is placed in the path of the waves has been dealt with by Stenzel, who calculated the intensity of the scattered sound as a function of the radius b of the sphere and the wave length λ. Again the form of this function

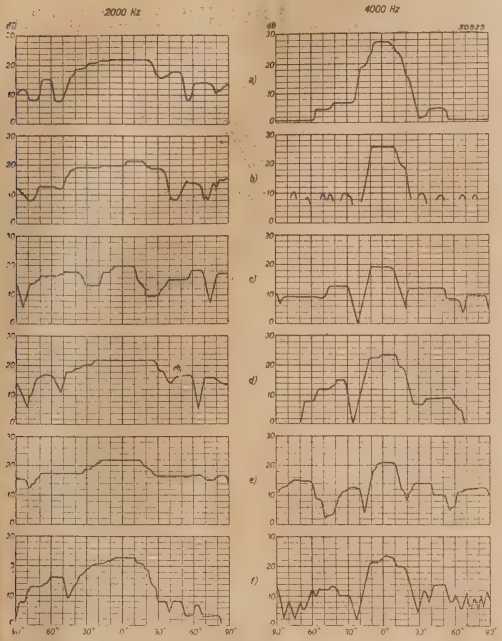

Fig. 4.—Measured directional distribution of the sound intensity of a loud speaker; the intensities are measured in decibels. The recordings on the left were made at 2000 c/s, those on the right at 4000 c/s. The sharp minima which sometimes occur at certain angles may be ascribed to interferences which are due to the fact that at these high frequencies the membrane no longer vibrates as a whole. The measurements were made in the open air. When the loud speaker is situated in a room of a private house the minima are not noticeable, since the sound reflected from the walls is added to the direct sound.

(a) Directional distribution without diffuser.
(b) Scattering cone with apex angle 20 degrees, 14 cm long
(c) Scattering cone with apex angle 50 degrees, 14 cm long.
(d) Scattering cone with apex angle 50 degrees, 6 cm long.
(e) Scattering partitions at about 50 degrees, 14 cm long.
(f) Scattering partitions at about 50 degrees, 6 cm long.

is found to be determined by a single parameter, namely b/λ. In *fig. 3* the results of the calculations are given for different values of the parameter. In practical cases the scattering which corresponds to the curve for $2\pi\ b/\lambda = 2$ is sufficient. If for the frequency region from 1000 to about 4000 c/s for example one desires to obtain approximately uniform scattering by means of a single scattering body, the dimensions of that body will have to be chosen to correspond to an average frequency, in this case therefore about 2000 c/s. A sphere with the radius $b = 6$ cm may then be used as sound diffuser. Since this dimension is of the same order of magnitude as that of ordinary loud speakers, all the sound from a loud speaker could be adequately scattered with only a sphere.

PRACTICAL CONSTRUCTION OF SOUND DIFFUSERS

For structural reasons a sphere is not very suitable for use as sound diffuser in a loud speaker. If a truncated cone is used instead of a sphere the construction is very simple. This shape is used in most of the Philips loud speakers (see *fig. 1*). The best form for the cone has been determined by a large number of experiments. In *figs. 4a-d* the results of some of the measurements are given. These measurements refer to a radio loud speaker cone with an apex angle of 104°, a depth of 6.4 cm and a radius of 10 cm. Scattering cones with an apex angle of 50° and an altitude of 6 cm (they do not extend outside of the loud speaker cone) are already found to give an appreciable result. With a larger apex angle (larger area of base) there is the chance that the sound will be decreased too much directly in front of the apparatus. The scattering becomes appreciably better, however, when the scattering cone extends farther out of the loud speaker cone (8 cm for instance).

In the construction of loud speakers for radio sets account must be taken of the necessity of housing them in a cabinet which must satisfy certain aesthetic requirements. Because of the shallowness of the space available for building in the loud speaker a scattering cone which extended very far out of the loud speaker cone would form an almost insurmountable obstacle in this respect. For this reason in the Philips loud speakers in the cases where an improvement on the scattering obtained by means of a small cone seemed desirable, a more intense scattering has been achieved by means of two vertical partitions placed symmetrically in front of the loud speaker cone. In this case also the most suitable dimensions and position were determined experimentally. In fig. *5e-f* results of several of these measurements are given. *Fig. 6* is a photograph of a loud speaker with partitions. The partitions can be incorporated into the design of the radio cabinet in a satisfactory manner.

While the form of the distribution of the intensity of the sound wave obtained when a cone is used as sound diffuser is rotationally symmetrical to the axis of the loud speaker, the sound is spread by the vertical partitions only in one horizontal plane. For use in private homes this is no objection since in this case the heads of all the listeners are at about the same height as the loud speaker.

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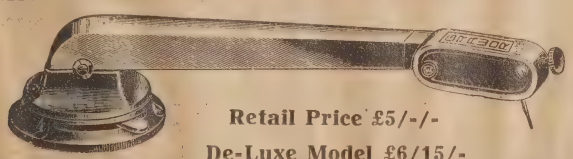

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THE IONOSPHERE AND ITS RELATION TO RADIO FREQUENCY

A summary of a lecture delivered to the Wireless Institute of Australia on June 15, 1939, this article will be welcomed by all who are interested in fading and skip-distance transmission on various frequencies.

By R. H. Healy, D.Sc., E. Inst. P.

INTRODUCTION

SHORT-WAVE circuits operating between wave-lengths of 10 and 100m. (30 and 3 mcs.) are dependent, in the majority of cases, on reflections from the ionised regions or layers in the atmosphere. In the absence of these reflections, communications by means of the ground ray alone is only possible up to comparatively short distances, the actual distance depending on such factors as the earth resistivity, the wave-length, and the height of the transmitter and receiver above earth.

The existence of such ionised regions was first suggested in 1902 by Heaviside, in England, and by Kennelly, in America. In 1918 Watson showed mathematically that a conducting shell round the earth would account for long-distance radio reception. It was not until 1925, however, that Appleton was able to demonstrate the existence of a layer about 100 km. above the earth. Shortly afterwards, during 1926 and 1927, he and his collaborators obtained evidence of a further layer at a height between 250 and 500 km.

There are three main reflecting regions in the ionosphere, the first at a mean height of approximately 110 km., known as the E-layer, the second at a mean height of about 200 km., known as the F1-layer, and the third at a mean height of 300 km., known as the F2-layer.

The height and density of these layers vary with time of the day, time of the year, sun-spot cycle and latitude, and these conditions in turn decide which layers control the communications at various distances on various wave-lengths.

2. COMMENTS OF LAYERS

The Normal E Layer or Heaviside-Kennelly Layer: The normal E-layer appears to be produced by an ultra-violet radiation from the sun. This is indicated by the fact that the density increases with the latitude of the sun, reaching a maximum for the day at local noon. The density is also greater in summer than in winter, and no normal E-layer is found during winter in the Polar region. Normal E-ionisation at night is due to a residual of that produced during the day, reaching a minimum at daybreak of about 5 per cent. of the maximum value.

Abnormal E Reflections: Reflections are sometimes observed from the heights of 100 to 150 km., which are in some cases unconnected with ultra-violet radiation (E2-layer).

The F1-layer: The F1-layer cannot always be observed as a separate layer. The ionisation of this layer seems to depend chiefly on ultra-violet radiation from the sun. The height of the F1-layer changes very little with the time of the year of the sun-spot cycle.

The F2-layer, or Appleton Layer: The F2-layer does not appear to depend upon ultra-violet radiation alone, but also on some type of corpuscular radiation which can be present in the absence of direct sunlight. This is indicated by the presence of this layer during long nights in the Arctic region. The height of this layer may vary from about 200 km. in the winter to 400 km. in the summer. The increase in height during summer months is probably associated with the expansion of the atmosphere.

3. REFLECTION OF RADIO WAVES

It is easy to show that the refractive index of an ionised region is given by the formula:—

$$\mu^2 = 1 - 4\pi Ne^2/m\omega^2$$

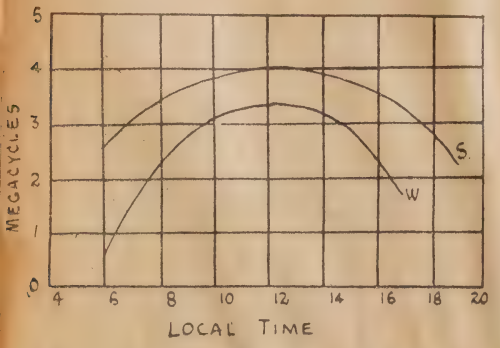
neglecting the effect of the magnetic field and electron collision frequencies. In this formula mu is the refractive index, e and m the charge and the mass of the ion, N the number of ions/cc, w the frequency of the radio wave. Reflection takes place when mu equals sin theta, where theta is the angle of incidence. The skip distance is given by the formula:—

$$d = 2H \tan\theta_C$$

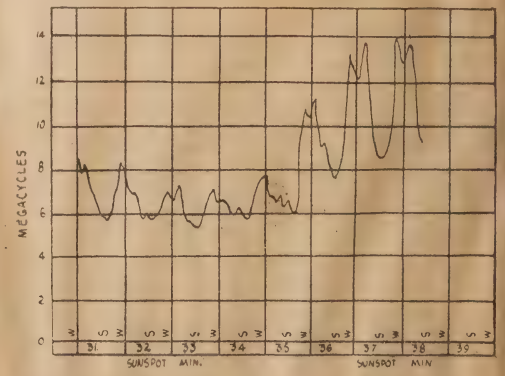
where d is the skip distance,
H the height of the layer,
Theta C the critical angle.

4. CRITICAL FREQUENCIES

Large numbers of measurements have been made of the critical frequencies of the several layers. The critical frequencies vary with:—



Variation of critical frequency F2, with change in Sunspot cycle. Washington midday values.



Diurnal variation in critical frequency E layer (ordinary ray). Sunspot maximum years. Washington Lat. 40N.

1. The time of the day.

2. The time of the year.

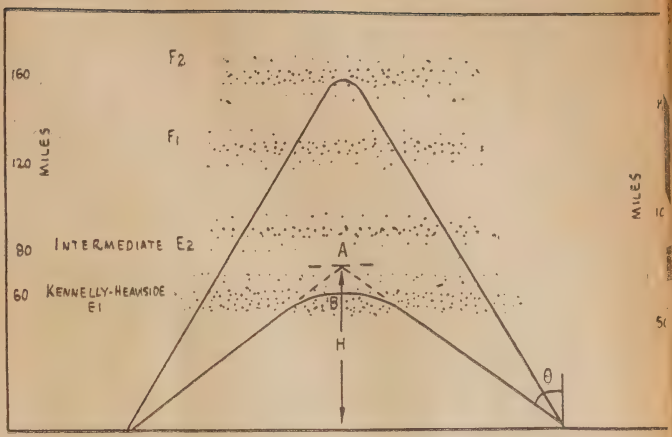
3. The sun-spot cycle (approx. 11 years).

The measurements shown in figs. 1 and 3 are made at vertical incidence. The maximum usable frequencies are naturally higher. A simple formula can be obtained connecting the critical frequencies at vertical incidence with the critical frequencies at other angles. It is:—

$$\omega'_c = \omega_c \sec. \theta$$

In practice, the maximum value of w'c seems to be approximately 3wc.

Systematic measurements have shown that wc for the F2-layer varied between 6 and 14 mcs. during the years 1931 and 1938. It follows that the maximum usable frequencies during these periods have varied between about 18 and 42 mc. (16.6 and 7.1m.). This conclusion appears to be in very good agreement with those reached by the Bureau of Standards (see report by Gilliland, Kirby, Smith, and Reymer, May, 1938). Moreover, it may be mentioned that the occasional reception of London television signals in America and in South Africa on the wave-length of 7m. indicates that at present this is close to the limiting value. It is important to note that at this low wave-length the skip distance is very great, having the value of about 3000 km. for 7m.



Showing the disposition of the various reflecting layers, their distances above the ground, their designation.

It seems safe to say that recepti on wave-lengths below 7m. will be ve rare, corresponding to the short peri abnormality of the E2-layer. It therefore, suggested that those of y who are interested in 5m. work shou consider it as suitable, in general, on for short distance communications.

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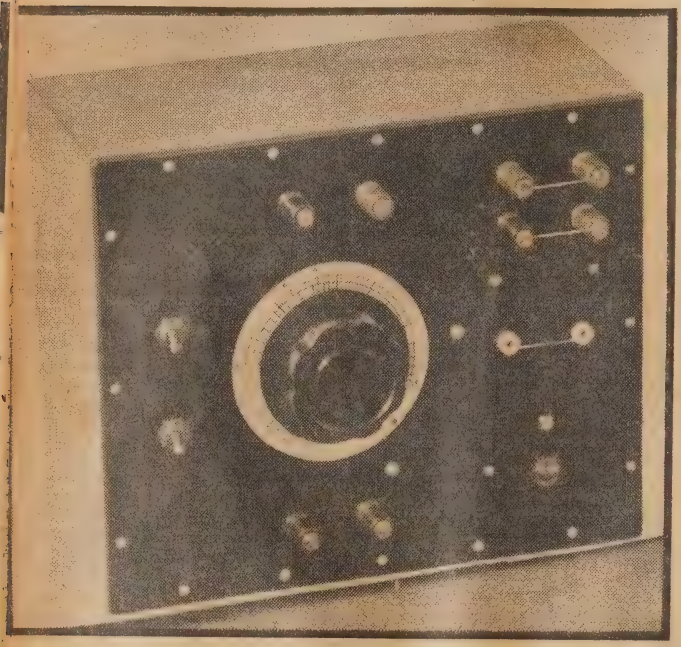
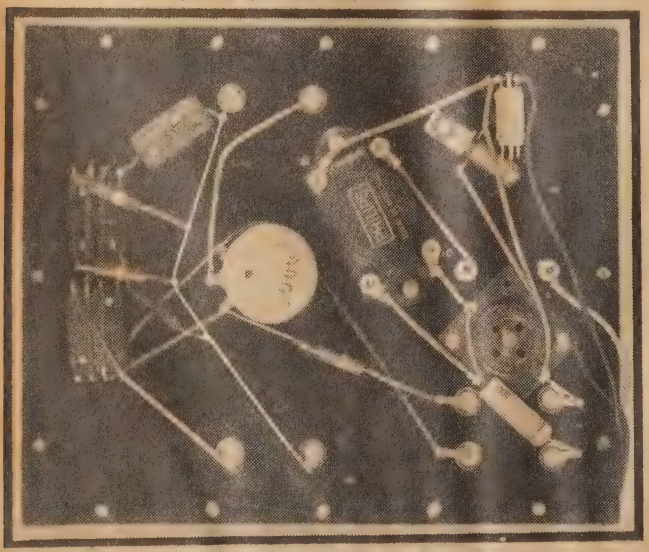
SERVICE

A RESISTANCE-CAPACITY BRIDGE

with built-in audio oscillator



The finished instrument is complete in a polished maple case. Push-back terminals provide quick and easy connection.



The wiring under the panel is simple and straightforward. Compare this picture with the panel layout and circuit. An indicator lamp is wired across the filament circuit —use a low-consumption bulb.

No one should have any trouble in building this excellent bridge for resistance and capacity measurements. The audio oscillator may be used independently of the bridge itself, and provides the required audio signal for its operation.

UNDOUBTEDLY any instrument that will readily measure the values of both condensers and resistors to a reasonable degree of accuracy, would be a valuable addition to any experimenters' test kit.

The following article describes a bridge, which by means of an ingenuous switching arrangement measures the values of condensers and resistors components over a wide range.

The bridge operates by comparing the condenser or resistor to be measured with one of known value. The accuracy of the measurement depends on two factors, firstly, how closely the relative values can be compared, and second by the accuracy of the standard. The basic circuit of a capacity bridge is shown in Fig. 1, and it is clearly seen that if the reactance of C2 and C1 are equal and R1 and R2 are the same, there will be no current passing through the headphones. If the moving contact on the potentiometer is set off centre, however, there will be a potential difference across the headphones, and a current will pass through them. If an audible tone is fed into the bridge and if the sliding arm is off centre this tone will be heard in the headphones. If the potentiometer is then adjusted till R1 equals R2 the tone will disappear, as no current can flow in the circuit.

If the two capacities are not equal, the balance point will not be the centre of the potentiometer. The balance point is a factor of the relative values of the condensers and is expressed as a simple relation—

$$R1 : XC2 :: R2 : XC1$$

Consequently—

$$\frac{R1}{R2} \text{ equals } \frac{C1}{C2}$$

If the two resistances can be measured accurately and the capacity of C2 is known, then the value of C1 can be obtained from the formula—

$$C1 \text{ equals } \frac{R1 \cdot C2}{R2}$$

The slide wire bridge is used quite often in practice, with the three known properties and the one unknown. However, if the resistances can be calibrated directly, the unknown condenser can be

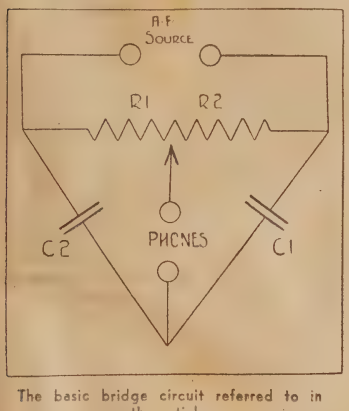
hooked to the bridge and the value read directly after the balance point has been noted.

RANGE

It should be theoretically possible to obtain all ratios of R1 to R2 on the ordinary potentiometer; and thus measure all capacities from zero to infinity. With the ordinary wire-wound potentiometer that is impossible, as the readings at the ends would be too cramped. However, with two standard condensers it is possible to measure from 10 mmfds. to 10 mfds.

The same bridge, but using standard resistors can be used for measuring resistor values, and if suitable values of standards are chosen the same scale will do for direct reading.

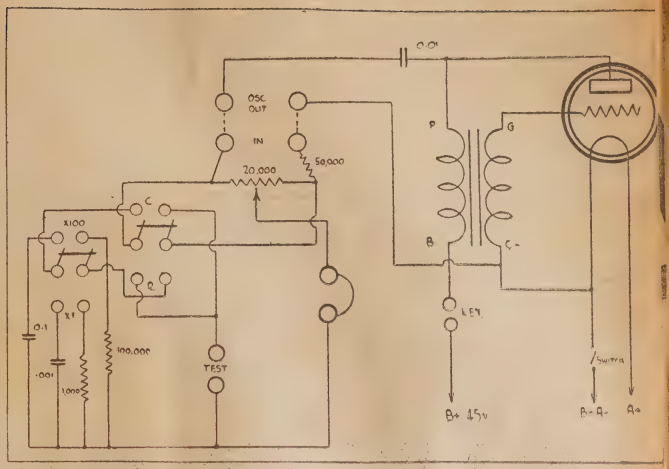
The bridge described combines these factors, and by using .001 mfds. condenser and 1000 ohm resistor standards, the lower range will read from 10 to 100,000 mmfds. for condensers, and 10 to 100,000 ohms for resistors respectively. The scale is calibrated to read from 10 to 100.000, and for the higher readings with the switch on the X100 position, the scale reading should be multiplied by 100. The 0.1 mfds. and 100,000 ohm standard give ranges from 1000 to 10,000,000 mmfds. (10mfds.) for condensers and 1000 to 10,000,000 ohms (10 megs.) for resistors.



The basic bridge circuit referred to in the article.

THE BRIDGE

The circuit of the bridge is seen in Fig. 2. A Radiokes 20,000 ohm potentiometer is used for a sliding resistor control, and two double pole double throw switches are used, one to change the bridge from resistance to capacity readings, and the second to change the constants. These switches are sometimes filled with petroleum jelly to prevent arcing and it is very necessary to remove this jelly before installing in the bridge, as it will upset the readings. The components should be of good quality, and the bridge will be useless unless the four constants at least accurate to— plus over minus 1 per cent.



The circuit employs a simple switching system for which we are indebted to the English "Wireless World."

If you desire to use the calibrated scale the variable resistor should be similar to the one used for the bridge. If it is individually calibrated it doesn't matter.

CONSTRUCTION

The bridge and oscillator are housed in a wooden box 11in. x 9in. x 5in. deep, with bakelite top panel, 11in. x 9in. The box is made large enough to house the batteries to run the oscillator.

The panel layout is seen in Fig. 3. The dial and pointer were made from a 3in. instrument knob and a small brass pointer stuck on with duco cement. The scale can be stuck on a piece of cardboard, as published, or can be redrawn to full size on another sheet. This scale can be fixed to the panel when lined with ordinary paste.

The terminals top and bottom of the dial are for the component to be measured, and the headphones respectively. The four terminals on the top right are the bridge input and the output of the oscillator. These could actually be connected direct, but to keep to oscillator a separate section for use other tests, these were separated. P jacks are also available for the use a key. For normal working the k plugs would be bridged, as would t oscillator output and bridge input.

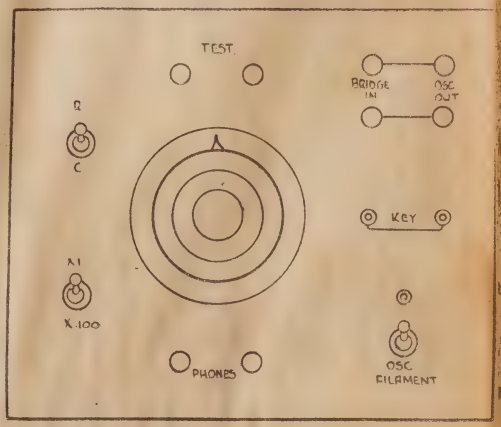
Any source of alternating current audio frequencies could be used energise the bridge. A buzzer cou be suitable; however, it would have be a very reliable one, and as th cost practically as much as the osc lator you would be well advised to u the latter.

If you really want to try a buzzer may be necessary to short the 50,0 ohm resistor in the input arm of t bridge. This resistor is used to redu the load of the bridge on the oscillato

THE AUDIO OSCILLATOR

The audio oscillator used is practica a replica of the one described in la issue. The only change in the circu is the elimination of the headphone te minals. The output is now fed throug a 0.01 mmfds. condenser to one te

(Continued on Next Page)



The panel layout, showing positions of all controls. This drawing is to scale. Note indicator bezel to show when the oscillator is turned on.

A Resistance Capacity Bridge

(Continued from Previous Page)

minal of the input of the bridge. The other connection from the bridge being brought back to the negative return of the oscillator. A type 30 tube was used and a 1½-volt cell for an A battery. The 90V battery on the plate of the oscillator may seem high, but the balance point on the bridge is much more clearly defined than with the regulation lower voltage.

The pilot lamp is really a matter for the individual; if you are methodical, will forget the lamp. But if you are not, well the .06 amp. current draw of the lamp will be well below the ultimate battery drain after the oscillator has been left on a few nights. Anyway, there is nothing prettier than a nice red glow when everything is set to go.

The batteries can be clamped in the box and the leads on the oscillator being made long enough to reach to batteries before the lid is on.

CALIBRATION AND USE

The bridge as already stated can be calibrated directly if desired. This individual calibration will undoubtedly be a little more accurate than the use of the scale, Fig. 4. For all general purposes the scale will prove quite effective.

The balance point spot on the dial where the audible tone reaches a minimum will be quite definite. The tone may not disappear altogether. This can be blamed to either self capacity in the resistor or resistance in the condenser under test. An accurate 1000 ohm resistor would be handy to set the mid-point on the scale, and once set can be disregarded.

The condenser or resistor to be checked is connected to the terminal on the bridge marked test, the balance point found, and the value read directly.

It would be wise to disconnect the component under test from all associate parts before checking.

While the resistance of the wiring and leads of the bridge would be negligible, there will be the self capacity of the bridge to consider when measuring condensers. The self capacity can be checked by reading the capacity showing at the balance point with nothing connected to the terminals marked Test. It will be around 30 mmfds. This capacity should be deducted from all capacities read below 1000 mmfds. Above that figure the adjustment can be neglected as the error would be so small.

It is quite apparent that variable condensers and resistors can also be checked and altogether the instrument will prove valuable to any experimenter.

If a little care is taken in manufacture the apparatus can be made to compare favorably with the other equipment, commercial and otherwise, that is reposing on the test bench.

BATTERIES AND 1.4 V. VALVES

ADVICE has been received from the valve manufacturers to the effect that the 1.4 volt valves have in a few instances been suffering from open-circuited filaments soon after a new A battery has been fitted.

The trouble is blamed on the fact that when such a battery is new its voltage is higher than the theoretical 1.5 volts, and may exceed the upper limit of filament voltage for the 1.4 volt valves.

It is therefore desirable to include in one of the filament leads a small resistor which will reduce the total voltage by .08 volts.

Accordingly we have had made a special little resistor for use of the R. and H. portable receiver, of .25 ohms in value. This should be just about right for full valve protection. The very slight voltage drop will not materially reduce the useful life of the battery.

TRY THIS WATERPROOF INK

TO make ink-written letters permanent and waterproof is not at all difficult. Mix a little glue with the ink, and drawings, signatures, etc., will be preserved indefinitely. Drawings can later be washed with soap and water and the ink will not run.

Some Curious Effects Of Ultra-Sound

Engineers are familiar with the fact that the properties of steel are modified gradually by vibrations imparted to the metal through moving parts of a machine. Many metals crystallise if kept for a time in vibrational motion.

By C. W. PORTER, Professor of Chemistry, University of California.

Chemical as well as physical changes are induced by vibration. Observe the difference in appearance in the rails of the main line and the rails of side-tracks and switches of the railroad. The rails on the side-tracks are rusty and the others are bright.

This is not due exclusively to the polishing effect of the car wheels on the top surface of the rails. The phenomenon is equally noticeable if the sides of the rails are examined. Trains pass frequently over the main line and each train imparts vibrational energy to the rails. The relative positions of the millions of positively and negatively charged points on the surface of the main line rails are altered many times daily by vigorous shaking.

Corrosion is an electro-chemical process and the metal becomes pitted if the positions of attack are not changed frequently. Corrosion also occurs in the rails that are shaken, but the process is slower, and instead of deep pits forming at the stationary points a uniform oxide film is produced. The section foreman says: "Busy iron doesn't rust."

It is of more interest to consider some of the effects of vibrations of great intensity and at frequencies beyond the audible range. Ordinary sound waves have very little energy. If all the energy of the sound waves of the voice of a lecturer could be absorbed and retained by a layer of water one centimeter thick —such a layer constituting the walls and ceiling of the auditorium—it would be necessary for the speaker to continue his address without interruption for one hundred years to raise the temperature of the water one degree.

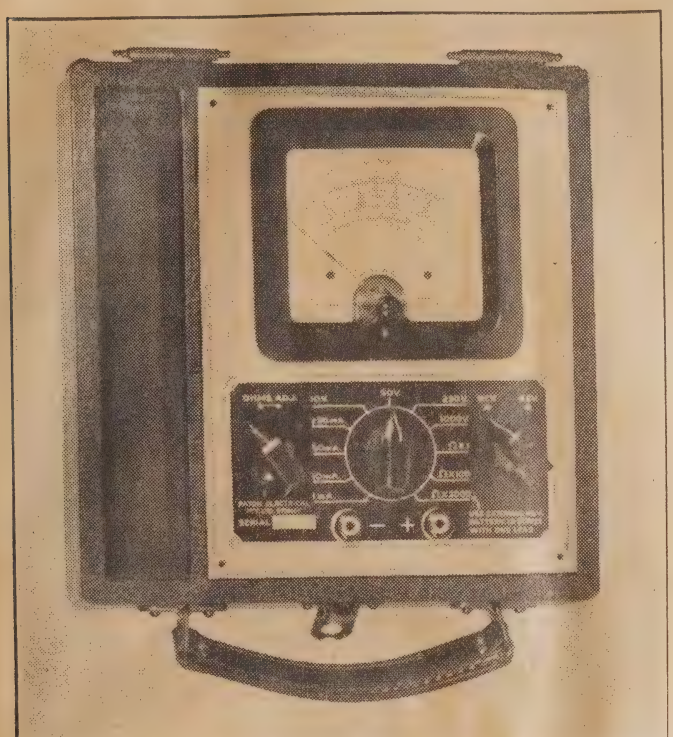
The sound from continuous firing of cannon, if completely absorbed by a water layer one centimeter thick, would require an hour to accomplish the same heating effect. It is obvious, therefore, that ordinary sound waves impart very little energy to the absorbing medium. We need at least a thousand times the vibrational energy of the roar of a cannon to accomplish a change in the structure of a comparatively unstable molecule of a chemical compound.

For my work on the mechanisms of some chemical reactions oscillators have been built which are capable of producing vibrations at frequencies between 10,000 and 500,000 cycles per second and supplying energy at the rate of two watts per square centimeter.

Unpleasant and perhaps injurious physiological effects are produced by long exposure to intense ultrasonic vibrations. After operating the magnetostriction oscillator continuously at 16,000 cycles per second for two hours a young woman who, normally, is especially quick and accurate in making mathematical computations is unable to solve simple arithmetical problems. The incessant hammering of these vibrations upon the eardrum produces a state of mental confusion. Reversed digits in the numbers she writes and logarithms copied from wrong lines are the most obvious manifestations of the physiological disturbance. When the machine has been in operation for an hour or more computations have to be postponed on account of the mental state of the operator.

A chemist in one of the large industrial organisations in this vicinity, working day after day with a piezo-electric oscillator producing approximately 500,000 vibrations per second, lost his sense of balance. He could no longer ride a bicycle and this amounted to a handicap in his case, for it was necessary for him to make frequent trips between widely separated laboratories. Physicians were unable to diagnose his trouble. He returned to a normal state of health, without medical aid, very soon after the work with the oscillator was completed.

ADDING A.C. TO YOUR MULTIMETE



A front view of the meter with the lid removed. The A.C. switch at the right.

Here is a description of the multimeter detailed in last month's issue, but with the addition of an oxide rectifier, in order that the range of volt readings may be extended to cover A.C. as well as D.C. It is quite a simple opera- and will increase the usefulness of your meter.

THE multimeter described in the July issue has attracted the attention of many of our readers, who have built it up for themselves.

More than once we have stressed the need for a good meter of this type for anyone engaged in radio work. The need is so great that one can say that it is really a necessity.

ACCURACY

Guesswork, these days, is definitely a thing of the past. It never was particularly desirable, of course, but modern circuits, and modern apparatus, depend more and more on accuracy for first-class performance.

In many cases, definite damage can be suffered by valves and other components if these are not operated under their rated conditions. If you want your receivers to be 100 per cent. satisfactory, you must know what voltages are being applied to your valves, in the first place.

CONVERTERS, FOR INSTANCE

Just one instance we can take is this matter of converter valves. Notwithstanding the fact that modern valves are robust, and will stand much ill-treatment, they can be damaged if over-run. In the case of the 6K8G, we are up against conditions which are more critical than in the case of the o types, such as the 6A7 and 6A8G.

The oscillator voltage for the 6K set down as 100 volts, and this sh not be exceeded. If it is, there h been cases in which the valve, aft while, has just lost its conversion a gether, with a great increase in n level and loss of efficiency. On other hand, if one plays safe, and i a screen voltage which is too low, best operation of the set cannot be tained.

Even with the rated dropping resi for plate and screen of 15,000 ohms is most desirable to check on this v age to make sure that it is not in ex of 100 volts, or, at the very most, to 120.

ONLY ONE EXAMPLE

We take this only as an example, not as an indication that the 6K8 i poor valve. On the contrary, we lik best of all converters which are av able at the present time. But it is o fair to see that it, with the other val in the set, has a fair chance.

We could instance also the 2A3 o put valves, which are used in ma modern amplifiers. Here again, w the various ratings set down for th valves, according to conditions, you wa to know that you are applying the ri plate and grid voltages required. Y can't know this unless you measure.

Fortunately, most of our readers n realise the truth of this statement, a are getting the "measure it" habit. Ev with the battery sets, things are ju as important. The new 1.4 volt val must never have more than 90 volts hi tension, and their filament requiremer likewise are critical above about volts.

THE A.C. RANGE

However, we are dealing specifical in this article with the addition of a A.C. range of volts to last month meter.

We have redrawn the circuit of t meter, to show the inclusion of th copper-oxide rectifier unit which allow the A.C. measurements to be made.

You will remember that the panel meter was ready drilled for th mounting of a double-pole, double-thro switch to take care of the A.C. range.

The diagrams show how this is fitte

ERVICE

E RECTIFIER

The little rectifier unit comes to you h four lugs for connection. Two of se will be marked, possibly in white, indicate connection to the leads rked A.C. in the diagram.

t doesn't matter which way round se leads are connected.

The lugs for connection to the D.C., wever, are important. These will prob- y be marked with red and black to ficate positive and negative.

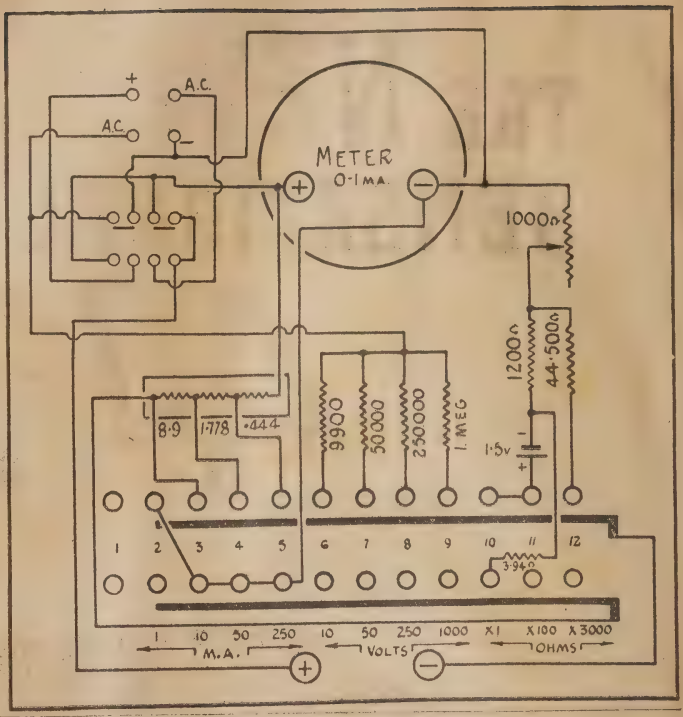
f you refer to the wiring diagram, u will see that we have marked the tifier connections plus and minus to respond with these lugs.

The rectifier unit in the diagram is signated by the four little circuits at e top of the diagram, and the switch nts are drawn immediately below it.

Very little alteration to the meter is quired. It is satisfactory to mount e rectifier so that it is supported by ft wire leads connecting straight into e circuit, as it weighs very little, and en so mounted is not likely to wave out where it shouldn't.

It is a good idea to use spaghetti in- lation over the leads, if you use bare re for connections. This makes short rcuits impossible.

The meter already has a scale to read C. volts. If you specify the make of ter when ordering the rectifier unit, u will have no trouble to get accurate easurements.



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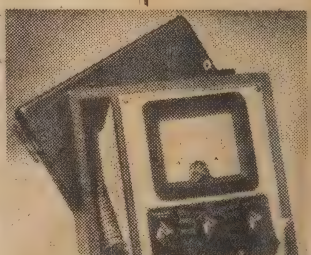

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0-500, 0-50,000 ohms with internal battery.
0-1.5 megohms with external 45V. Battery.

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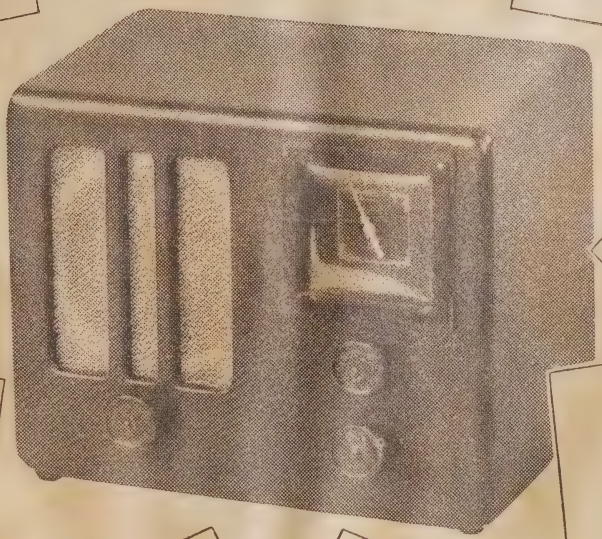
THE NEW SENSATIONAL — 4/39

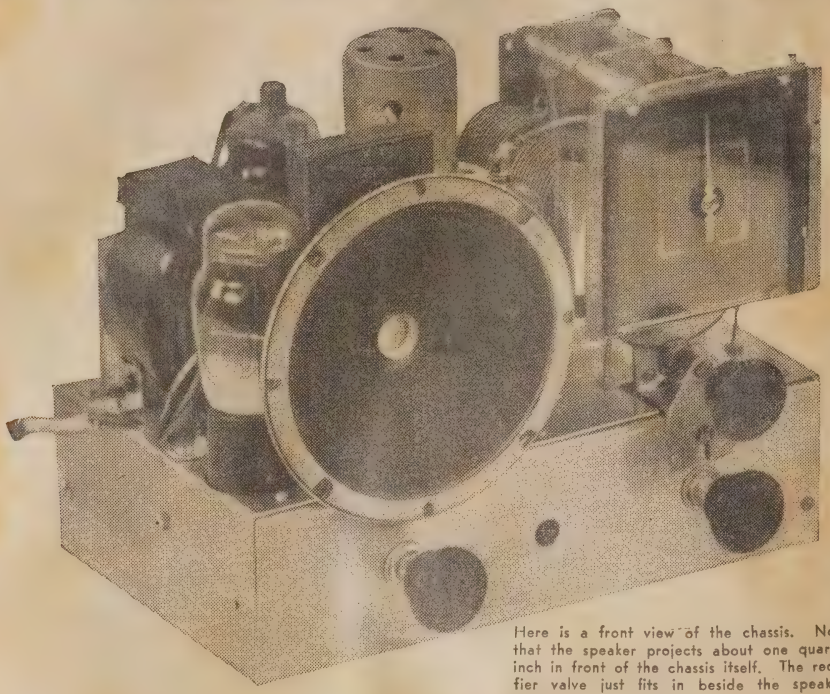


DUAL-WAVE MIDGET

FULL CONSTRUCTIONAL DETAILS

SET-BUILDING

THE BABY SET OF THE YEAR!



Here is a front view of the chassis. Note that the speaker projects about one quarter inch in front of the chassis itself. The rectifier valve just fits in beside the speaker, without actually touching.

The demand for a very small receiver, which will present a high standard of performance in a small space, has prompted us to design the 4/39 receiver. Unlike many such tiny sets, it is a Dual-waver, and will give first-rate reception on short waves as well as on the broadcast band. It's overall measurements are only about 10 x 7 x 8 inches, and a special cabinet is available for it. We confidently expect that the 4/39 will be one of our most popular designs, because it really is good!

By JOHN MOYLE

In the next few pages of "Radio and Hobbies" you will find described a new receiver, which we think will make the ace this year for sets of its type.

Radio fashions come and go. We go with them. One of the things we have to do is to find out what our readers and the public want. Then we do our best to give it to them.

At the present time there is a decided tendency among the buying public to purchase baby receivers. Not just mantel sets, but real midgets. Sets which you can take up literally in one hand, and yet which pack a real radio punch when put to the test.

The fascination of the midget radio is not just a single thing—it's a collection of a number of things.

In the first place, it is amusing and interesting to hear music and speech coming from a small box only a few inches either way. So long have we been used to large cabinets that, to many, the phenomena doesn't seem possible.

Overseas, of course, they make even midgetier midgets than we have ever seen in Australia. Such sets are, however, suited only to mass production, and where prices are so low that it doesn't pay to repair them when they go wrong.

Also, we have had a chance to use one or two of them, and they do savor just a bit of the cheap and nasty, to use a well-understood phrase.

However, be that as it may, we feel that a large number of the new midget radios are going to be sold in the next few months. In order to keep our constructionally-minded readers abreast of the times, we have also built a midget radio. We think it is a pretty good one. We don't think you will be able to get one much better, no matter what you pay. In fact, our little set can do things that many others cannot.

It is very hard these days, when prices of radio material can vary so much, to give an estimate of cost on a set like this one. However, everyone, no matter how good or bad the parts they buy, should be able to receive considerable change from a ten pound note, when everything has been purchased. Remembering that our little set will tune both broadcast and short-wave stations, you must agree that here we have got something!

CONVENIENCE

We have spoken of the fascination in receiving programmes on a baby set.

THE WORLD IN A NUT-SHELL

There is more appeal than that of convenience, however, in such receivers. Every home, no matter whether there is a bigger radio installed or not, will find use for the little job.

It is so portable. It can be taken round into any part of the house, as long as there is a power point within reach. It will work quite well on the local stations with only a few feet of aerial. It gives all the volume one could require for casual or bedside listening, and doesn't need turning up so loud that all the house must hear it. It is surprising how clearly you can hear all that is going on, with the set a few feet from you on a table, and the volume little more than a whisper.

It can be taken into the kitchen while the morning's work progresses—into the nursery, into the bedroom, and even into the bathroom, if you like. You can easily take it away with you on holiday, as long as there is A.C. where you are going. It weighs very little, and is easily packed and carried.

PERFORMANCE

And don't run away with the idea that it is a poor performer. With the 4/39, if that is your opinion, you are in for a rude shock.

On the broadcast band there appears to be nothing at all that it cannot tune in. In this regard, it will probably be just as good as your big set. It ought to be, because the coil unit we have used is of much the same type, and has been specially produced for use with it. It could be used with equal advantage on a bigger set, and we probably will use it so before long.

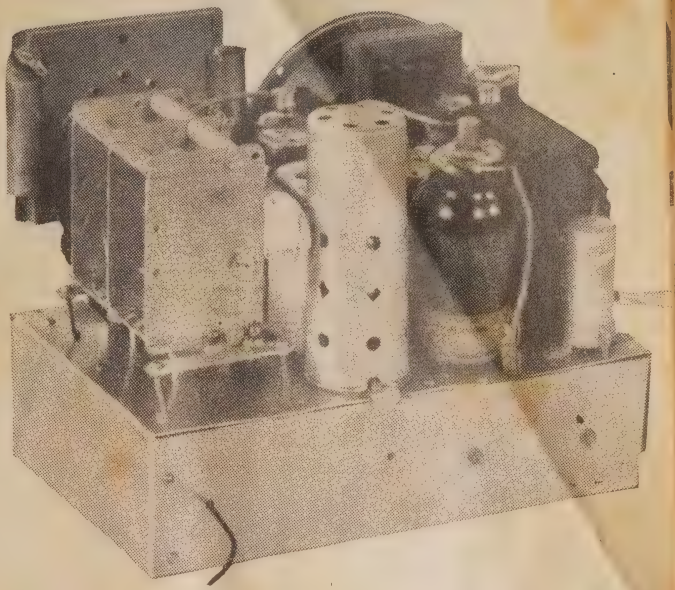
Every part except the speaker is exactly the same as would be placed in a larger receiver. There are no concessions to be made in this direction because it is small.

On short waves, it will really amaze you. Except for volume and selectivity, it raced along beside the special Seven Valve Short Waver in this issue, in a manner which positively startled us. It will be grossly unfair to wrinkle your nose, doubting that a set so small could be any good on the short waves. If there is anything on the short wave bands worth listening to, you will hear it at excellent strength. The main stations to which everyone listens will, under favorable conditions, overload the loud-speaker, and almost disturb your neighbors!

WHY?

There is, of course, a reason for all this. You look at the circuit, and, at first glance, note that there are only three valves and a rectifier. But have another look, and you will see that every valve is of a type which performs two purposes, and, in the case of the output valve, three.

Don't get things mixed up with reflex circuits. Plenty of people have worried themselves to death trying to make reflex circuits work. This circuit definitely uses no reflexing of any sort.

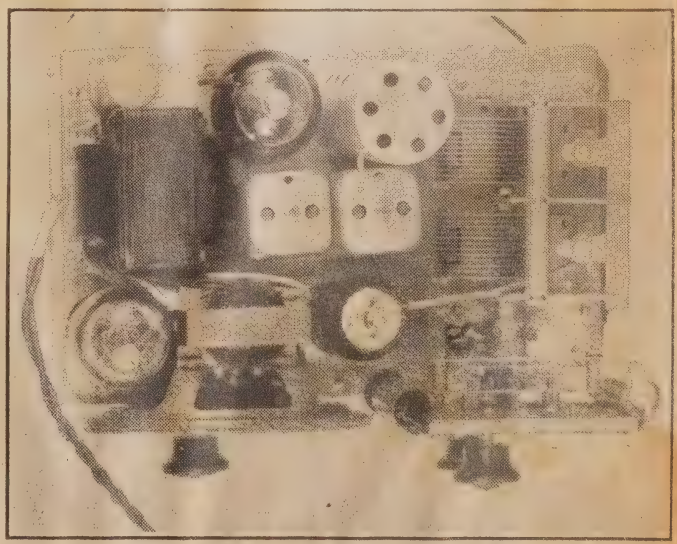


The set from the rear. The 6F7 should have a valve can over it—next to it is the EBL1. The tiny electrolytic can be observed immediately behind the special power transformer.

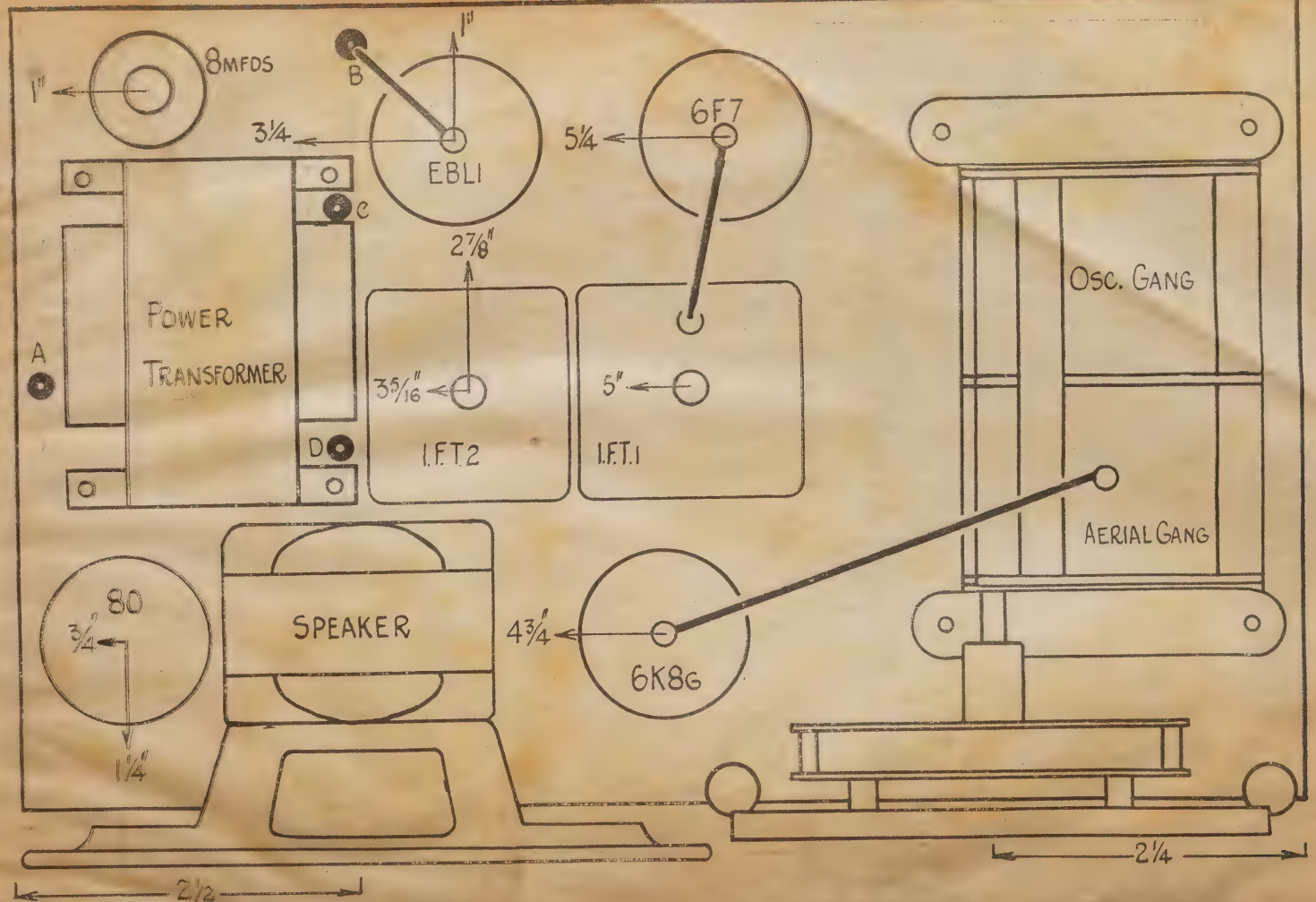
The multiple purposes served by the valves are the result of their special construction—they were made specifically to work that way.

THE CIRCUIT

So let us consider the circuit, and how it is all done.



Compare this plan view with the full-sized chassis diagram on a later page. The parts are small, but all standard types.


8MFDS
1"
B
1"
3¼
EBL1
5¼
6F7
C
2⅞"
POWER
TRANSFORMER
A
D
3 5/16"
I.F.T.2
5"
I.F.T.1
Osc. GANG
AERIAL GANG
80
¾"
1¼"
SPEAKER
4¾
6K8G
2½
2¼

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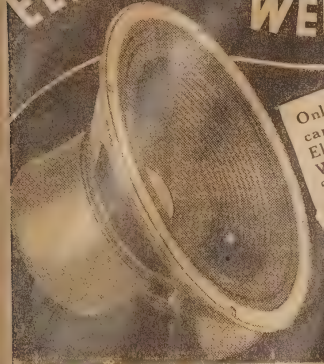

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The first valve is the converter. We have used two types of converter in this set, with equal success in each case. The 6A8G was actually in the set when the pictures were taken. It was wired in place of the more modern 6K8G just to see how it would work. If anything, the 6K8G is the better valve on short waves, and so we have specified it. Also, its connection is simpler than the 6A8G. However, should you happen to have a 6A8G or a 6A7, it will operate very well, indeed, if the circuit is modified to allow for 150 volts on the oscillator plate.

This converter valve really is a double type, functioning as mixer and H.F. oscillator. However, all sets use these valves now, so we don't class it as a true double-purpose type.

INTERMEDIATE AMPLIFIER

The intermediate amplifier is a valve which we don't hear very much about, but which is particularly suited to our circuit. It is the type 6F7.

This valve has two distinct sections using the same cathode. One of these is a high-frequency pentode, and the other a small triode. Either section may be used on its own, or each may be used in different parts of the circuit for different purposes. However, more of this later.

We use the pentode section here as the intermediate amplifier. It makes quite a good one, not quite as good as the straight 6D6 or 6U7G, but better than the often used 6B7S. It might be classed as a medium gain type in comparison with the valves available.

SECOND DETECTOR

Most modern receivers use A.V.C. and diode detection these days—both very handy things, particularly on short waves. But many modern midget sets do not. By the using of the EBL1 type of duo-diode output pentode, we are able to include both these features in our circuit.

The EBL1 has a pair of diode plates in the same envelope as a very sensitive output section. It was originally built so that the pentode section could be operated straight from one of the diodes as a detector. This provides plenty of lift for broadcast work, and we used a similar arrangement in the 4/38 receivers of last year.

But, on short waves, we could do with a bit more lift after the detector before hitching the signal to the output valve.

This is the reason we have used the 6F7. It has a triode section which we can use as an audio amplifier, with an amplification factor of 8. This is low compared with that of the 75 type, for instance, which has a factor of 100. But it is better than none at all, and as the output pentode is much more sensitive than the average American type we make up nearly as much total gain as this latter combination.

Thus, we double back from one of the EBL1 diodes to this triode section of the 6F7. The other diode plate is used for A.V.C., and is energised from the detector diode itself, in one of the well-known hookups.

From the 6F7 triode, as we have said, the signal is fed to the EBL1, and thence to the loudspeaker.

PARTS LIST
4/39 MANTEL SET

1 Chassis, 9½ x 6 x 2½.
1 AJ11 tuning dial.
1 Special dual wave bracket.
2 465 kc intermediates.
1 Power transformer, 40 m.a. at 385V., with 6.3-volt winding.
1 2-gang tuning condenser without trimmers.
1 .5 meg. potentiometer.
3 1 meg. resistors. 1 .25 meg. resistor.
1 .5 meg. resistor. 1 .1 meg. resistor.
1 50,000 ohms resistor.
1 10,000 ohms resistor.
2 50 ohms resistors, W.W.
1 .1 mfds. tubular condenser.
1 .05 mfd. tubular condenser.
2 .01 tubular condensers.
1 .0005 mfds. mica condenser.
2 .0001 mfds. mica condensers.
2 8 mfds. midget electrolytics.
Sockets—1 octal, 1 small 7-pin, 1 P-base, 1 4-pin.
Valves—6K8G, 6F7, EBL1, 80.
1 Valve can.
Speaker—Midget type, 1500 ohms, field coil matched for pentode.
Cabinet—See article.

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FOR THE 4/39 MANTEL SET

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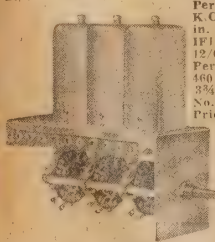
Air Core, 2nd, 460 K.C., sq. can, 3in. x 1⅝in. Cat. No. IF108. Retail Price, 7/6.

Iron Core, 1st, 469 K.C., sq. can, 3in. x 1⅝in. Cat. No. IF109. Retail Price, 10/6.

Iron Core, 2nd, 460 K.C., sq. can, 3in. x 1⅝in. Cat. No. IF110. Retail Price, 10/6.



Perm. Tuned, 1st, 460 K.C., square can, 3¾ in. x 1⅝in. Cat. No. IF113. Retail Price, 12/6.

Perm. Tuned, 2nd, 460 K.C., square can, 3¾in. x 1⅝in. Cat. No. IF114. Retail Price, 12/6.

DUAL WAVE UNIT

B/C 1500 to 550 K.C. S/W 16 to 50 Metres. Aerial, R.F., and Oscillator, 460 K.C., A.C. Cat. No. DW24. Retail Price, £3/3/-. Aerial, R.F., and Oscillator, 460 K.C. Battery. Cat. No. DW25. Retail Price, £3/3/-.

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Beat Frequency Oscillator Coil. Cat. No. F96. Retail Price, 11/9 each.

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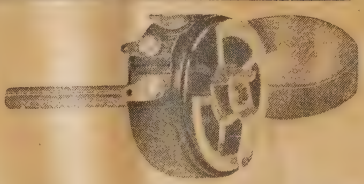
Permeability Tuned Aerial Coil, 460 K.C. Cat. N. E279. Retail Price, 7/6 ea.

Permeability Tuned R.F. Coil, 460 K.C. Cat. No. E280. Retail Price, 7/6 ea.

Permeability Tuned Oscillator Coil, 4 K.C. Cat. No. E281. Retail Price, 7/6 e



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20 " "	.25 Amp.	" "	PT39	4/6
30 " "	.25 Amp.	" "	PT34	4/6
400 " Potentiometer	50 M/A	" "	PT46	4/6
1000 " "	35 M/A	" "	PT47	4/6
2500 " "	30 M/A	" "	PT49	4/6
5000 " "	30 M/A	" "	PT51	4/6
10000 " "	20 M/A	" "	PT52	4/6
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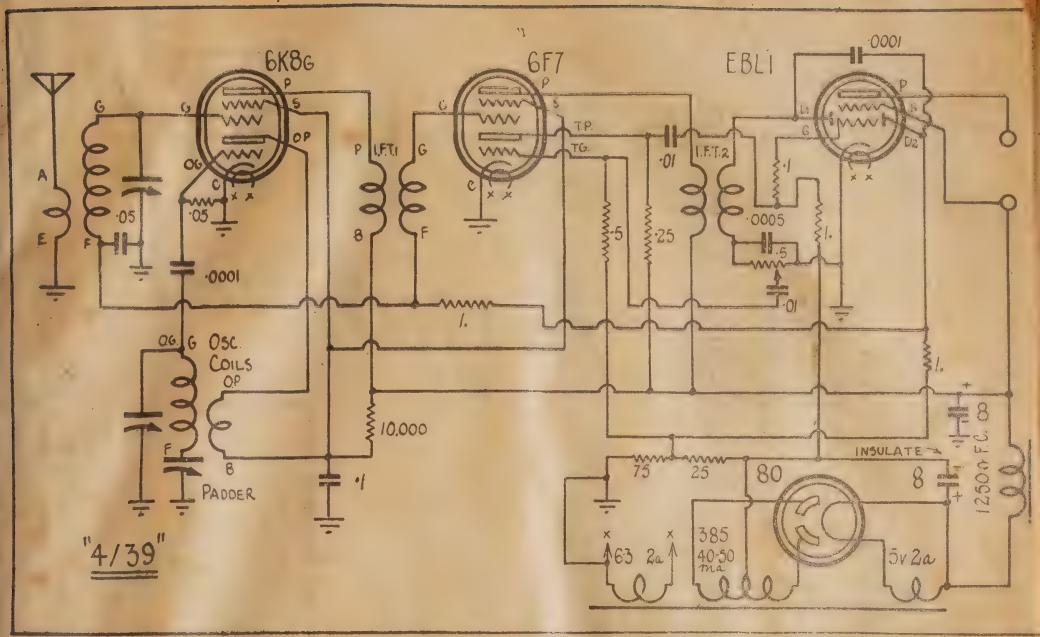
15	3	3	CV35	3/3	CV42	
25	3.5	4	CV36	3/6	CV43	
35	4	5	CV37	3/9	CV44	
50	4	7	CV38	4/3	CV45	
70	5	9	CV39	4/9	CV48	
100	6	11	CV40	5/3	CV47	



The circuit is as simple and straight forward as possible. Note the special biassing system employed.

FOR SPECIAL NOTE

There are one or two points about the circuit which are a trifle unusual, and we say now a few words about them.

In the first place, you will notice that back-biassing is used. Apart from saving a couple of components, there is another reason for this.

The triode section of the 6F7 is operated as an audio amplifier, and for best results requires a fixed bias on the grid.

The pentode section is the I.F. amplifier, and is connected to the A.V.C. line. In other words, its bias will vary, naturally, with the received signal, which, in turn, will cause its plate current to change over wide range as the set is tuned from one station to another.

If we used the normal method of obtaining bias from a cathode resistor, it would not be possible to keep the triode section at a fixed value of bias. Remember that the valves have the same cathode, and on a strong signal we would find the triode with too much bias, and on a weak one possibly with not enough.

To overcome this trouble we provide a back-biassing resistor which will allow approximately the right bias for the output pentode, which is 4.5 volts. If we use a bias resistor with tappings on it, or alternatively a resistor which is actually two or three small values in series, to make up the required resistance of about 100 ohms, we can tap any amount of bias we require between zero and 4.5; the maximum.

So the grid return for the EBL1 is connected to the centre-tap of the high voltage winding, in which position it receives always its 4.5 volt negative.

If we connect two resistors, one of 75 ohms, and one of 25 ohms, in series, the 75 ohms resistor being grounded at one end, we will get about 3 volts at the junction of the two.

FOR 3 VOLTS

This three volts will be just right for the grid return of the 6F7 triode section, and may also be used for the standing bias on the A.V.C. system.

The 6F7 pentode section has a minimum bias rating of 3 volts, and, as a rule, it is wise to keep this figure in mind. Both the 6A8G and the 6K8 may be run at zero bias, but it would be awkward and unnecessary to split the two controlled valves for this condition. We have tried returning the A.V.C. line anywhere between 1.5 and 3 volts, and good operation is possible on both ratings.

It may be remembered that there is nearly always some signal or noise being received, which will cause some voltage to be developed in the A.V.C. circuit, so even with this A.V.C. return connected to ground the zero bias conditions are rarely if ever obtained.

We have found utmost sensitivity obtained with two 50 ohms resistors in series, the 6F7 being connected to the junction for about 2.2 volts bias, and by using a centre tapped filament resistor for the second 50 ohm section, we have been able to get about 1 volt (developed across the 25 ohms section) from the A.V.C.

However, to keep strictly to the maker's specifications, we have specified the two values of 75 and 25 ohms which will give approximately 3 and 4.5 volts bias. The only difference will be noticed on a short wave, and it isn't very much. There is plenty of gain with either connection.

However, should you have any trouble in obtaining resistors of the values specified, two 50 ohm types will work quite well.

OUTPUT CIRCUIT

You will notice that the EBL1 has a .1 meg resistor in series with the lead to the control grid, which, by the way, is at the top of the envelope. This resistor is advisable in case there should be any parasitic oscillations developed in the EBL1 circuit. With such high efficiency valves, this sometimes occurs and the makers advise that this resistor be included at all times, as a preventive.

LAYOUT

Now for the matter of layout. A glance at the chassis will reveal that there isn't much space wasted! You may think it a simple matter to lay out a chassis with standard parts, to keep

A special cabinet has been designed for the 4/39, so that you will have no difficulty in housing it. The cabinet, advertised in this issue, can be obtained for approximately ten shillings. It is ready with holes cut for spindles and dial.

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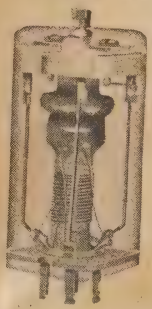

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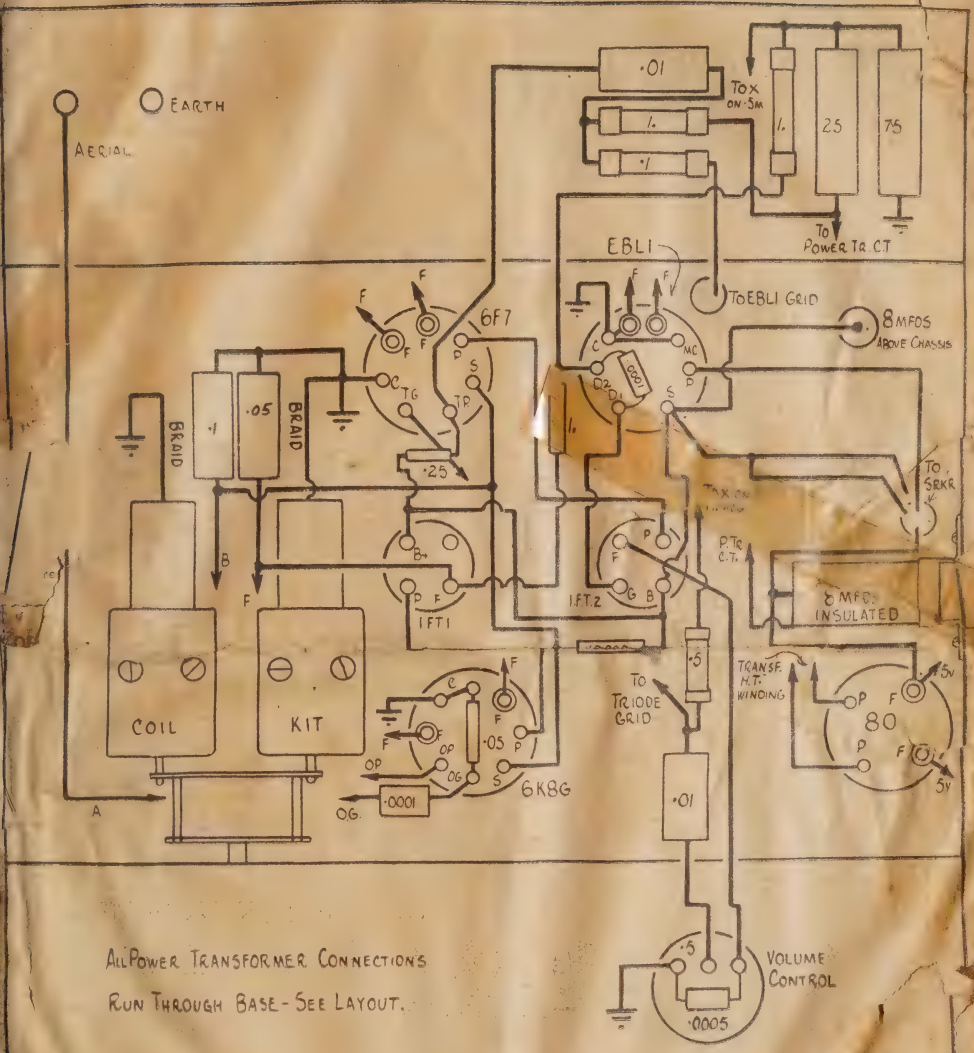

small. If you can think of any to make it smaller than it is, you one up on us! We confess that we the set three times before all the were satisfactorily in place. In we ran out of chassis in the end, had to build up the one photo- ed out of scrap aluminium, the being all shut over the week-end which we made it up!

the set covered the broadcast band only, we could have made it something like two inches less in height, so that its overall size would have been 9½ inches along the front, 6 inches deep, and 6 inches high. We got it down to that size, only to find that we had cut so much away from the front of the chassis that there was no room for the controls to mount in place!

As the little tuning coil assembly has to go underneath the chassis and as the AJ11 dial was the smallest one with any pretensions to decency that we could find, there was no help for it. The chassis, therefore, is a great big bulky affair, measuring 9½ x 6 x 8 inches.

It is so well packed that we are sup- plying a full-sized diagram showing the main centres of all components. When cutting your own chassis, if you do you should find it quite easy to get everything in place. There is a latitude

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of fractions of an inch for most to make it easier!

NO TRICK WIRING

It would be as well to poi at this stage that although t has been built on such a small this doesn't mean that you wi to build it with a button-hook hand, and an eye-glass in the ot that we have done is to arrar main parts so that they are as each other as possible above the If you look at the photo of the chassis wiring you will see that plenty of room for constructiona So please don't get scared beca can't wire a chassis that cov than about half an acre. And cuit is particularly simple.

THE LAYOUT

A quick run through the la the set would be a good plan.

You can see that the spe mounted on the chassis—it h bracket attached to the lan this purpose.

Right up against it you wi rectifier, which seems to be alw ing off the chassis. It isn't go will probably have to slice a sou side of the socket, to fit it, t If you use Tasma socket soc slice plenty off the wafer ge ger of the contacts touchi The 1¼ inch hole for the come right to the edge of and the valve will stand in pla actually touching the cabine speaker—not that it matters m does. Don't let it rest agains of the speaker transformer. as the 80 bulb gets pretty hot.

GANG AND DIAL

At the right-hand side of th the gang and dial are moun gang is a full-sized type—we us Stromberg—and is held up chassis by 1-inch long brass bo is to allow the dial to rest or of the chassis in a manner sho pictures. You will probably snip a little off the front moun of the dial, if it projects down chassis line. The condenser ed at the extreme right of th and runs almost to the back.

To the side of the condense see the converter valve. Its connects to the front sectio gang, the rear section tuning lator coils. The leads for the come up from underneath t from the coil unit.

INTERMEDIATES

These are placed centrall chassis, where the wiring shortest.

The 6F7 is immediately b intermediates, in the coil can. get oscillation without the c one of the type as shown in t You may need to make a sm it at the side, to prevent t plates of the gang from fo they turn

The EBL1 is mounted a alongside the 6F7.

e power transformer is a special made up for this set by Henderson, ugh suitable transformers are to be e available in Radiokes and other ds.

stands up on the chassis on four feet, which can be made of alumin- if they are not fitted. The leads it run down through two holes e in the chassis, and are soldered stly into the circuit.

ehind the transformer you will see of the main filter condensers. Don't ot our veracity—that condenser, one he new Ducons, is 8 mfds, 525 volt ag. It stands on two feet, and a in the chassis allows the solder lug project through it for connection the circuit.

ote that the speaker projects just enough in front of the chassis to d cutting away the metal to accom- ate it. This isn't waste space, be- e some tolerance is required for the escutcheon to come through the he'

on an insulation strip. We understand that special washers are obtainable with these condensers which will make this strip unnecessary. But the can must not under any circumstances actually make contact with the chassis, otherwise you will short-circuit the bias resistor, with dire results. This is, of course, normal practice with back-biassing.

The EBL1, we understand, is only available in the special moulded "P" type base, the connections to which are not the same as to an octal socket. The 6F7 likewise is obtainable only in a small seven-pin base—please make a note of this. The converter is made, in both types, for an octal socket.

There is no speaker plug. The leads are more easily carried through a hole in the chassis top, and wired straight into the circuit.

THE SPEAKER

This is a very small one, and has a field resistance of 1250 ohms. One of the

COLOR CODE FOR COILS

erial Gang—White
scillator Gang—Yellow
erial—Black
Oscillator Grid—Yellow
Oscillator Plate—Red
Oscillator B Plus—Blue
Earth—Copper Braids

NOTE—The manufacturers specify that the two copper braids must not be connected to the same earthing point.

ntermediates used are two Trolitol air-cored types—No. 2, serial number 108. For est results high gain, and freedom from instability, these intermediates, obtainable in Radiokes and R.C.S. brands, are recommended.

DER THE CHASSIS

[illegible]

u will easily recognise the special unit made for this set. It is very ll, and fits nicely under the 2½ inches chassis.

ere are four trimming condensers the unit. Two of these are for the adcast band aerial and oscillator The third is for the short-wave al coil, and the fourth is the broad- padding condenser.

ere is no trimming condenser for short waves, on the oscillator sec- The coils are accurately wound the factory, and it is only necessary ke the aerial section to the oscil- r for best results. The short-wave ning condenser is a fixed type, and eady wired into the unit.

e unit is color-coded, with leads for nection into the circuit. We give color-code elsewhere in this article, you can't very well go wrong with it.

ISTOR STRIPS

the sake of easy wiring, most of small parts are mounted on resistor s, and bolted to the back of the sis. This makes for neater work, prevents a horrible tangle which wise might occur. One or two e across the chassis, but these are ht clear, and are easier mounted this way.

te that the second electrolytic, h must have its can connected to gative-voltage centre-tap, and in- om the chassis, is also mounted

disadvantages of these baby sets is that their [illegible] is limited, and that [illegible] as good as a bigger set, because of the small cabinet [illegible] poor baffling of the little cabinet. But when you hear one of the 4/39 sets in action you will agree that the results are far and away better on both these scores than you believed possible.

It would rarely be necessary to run the set to its limit without straining your ear-drums. But fair is fair, and you wouldn't believe us if we told you that results were as good as the best console, after the manner of some happily rare advertisements.

THE CABINET

You can please yourself about the cabinet, but we have gone to the trouble to have one specially designed and built for this set. It is finished in imitation leather, and is similar in this regard to the cabinet we had made for the R. & H Portable. It is quite cheap, and very solid and serviceable. All the holes are ready cut for spindles and dial, and you would do well to buy it with the other parts. Then you can just check up before finally screwing things down, to make sure everything fits into place. The measurements we gave the cabinetmaker are exactly those of a sample cabinet we built ourselves as soon as the set was completed. Appearance is smart and unusual—our cabinet was in green, although you can have other colors, such as red, brown, blue, or black.

The set works well on an ordinary

(Continued on Page 75)

THE
CABINET
BY WESTERN

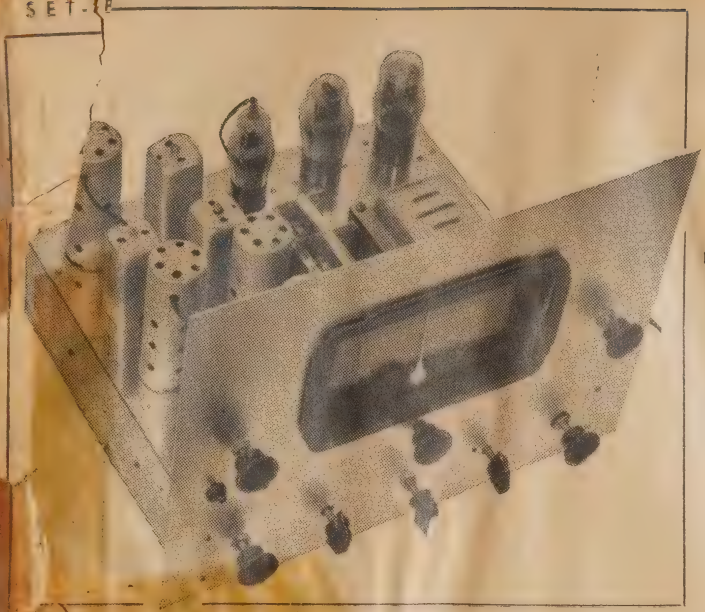
We are specialists in making for Portable Receivers, Mantel Midget Sets, Test Apparatus, Recent extensions to our plant enable us to quickly and efficiently meet your demands.

The Cabinet for Radio and Hobbies Receiver was made by Western exactly as specified by the Technical Editor. Obtainable in five colors. Ask your radio dealer, or contact us direct.

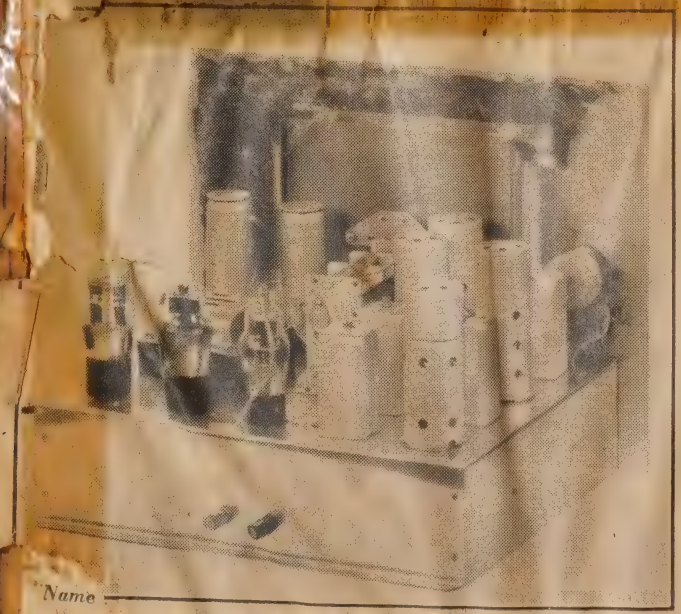
The popular R. & H. Portable also used a Western Cabinet. Supplied in five colors, with lid attached, ready cut for dial and control spindles. If you specify WESTERN, you will be satisfied.

WESTERN MANUFACTURING COMPANY

THIRD AVENUE, FIVE[illegible]
'PHONE [illegible]



This general view of the set shows that it is a very handsome affair. Our front panel is of aluminium, finished off with a bath of caustic soda, to give it a pleasant matt finish. The R.F. control is at top left, and beneath it the A.V.C. and beat switches. Below is the I.F. gain control. Then follow R.F. Trimmer, Wave-change Switch, Detector Trimmer, and audio control. Above the last mentioned is tone control.



the rear. The 6C8G is in the centre, with the beat oscillator coil to the left of it.

Name _____

Address _____

A NEW

SHORT-WAVE receivers have al been popular with readers "Wireless Weekly," and, of co "Radio and Hobbies." Some o may have wondered why we spen much time and trouble describing t Most of you will not, because you be interested in short waves yourse

For some time now we have re nised the desire of many people a good short-wave set—not an ama receiver, but one which will suit requirements of the short-wave list

As a matter of fact, we have a leaning towards such a set ours for some time, knowing just how h an efficient short-waver can be. though a modern dual-wave set is good on short waves, we can alway with something better, especially there are probably other members o household who don't want to hear s waves all night, even though we do

Whatever the reasons, let us tak for granted that the short-wave l er's set is definitely desired. Thr step is, what shall we put in it?

DIFFERENT FROM AMATEUR SE

One reason why we must attack problem from a new angle is b amateur sets and straight short- sets are the best today. It is al impossible to make a set ideal amateur requirements which will al ideal for the short-wave fan.

The amateur isn't interested in happens outside the narrow bands aside for his use. These bands quite narrow—only a few metres a most.

As a result, the amateur will us arrange that his receiver tunes over these bands. He plugs in on which will cover the band at 20 m a second set for 40 metres, and s What takes place between these b he doesn't want to know. He m his set so that the full dial spre arranged to cover only one ban a time.

But the short-wave listener is ferent. He wants everything. He w to search the ether from here to t and find out what's going on!

It is easier to make a set eff when covering the small amateur b than it is when covering, say, 20 m in one swing. By the use of cer controlled regeneration, &c., amaz good results are possible on su receiver.

But when it comes to designing to cover the larger section of the trum, it is quite another matter.

In many ways it is not desir have critical controls on a set is not to be operated by an Regeneration, for instance, is well in the hands of a man doing five things at once, but

EVEN VALVE SHORT-WAVER

SPECIALLY DESIGNED FOR S.W. LISTENERS

Here is the set that many of you have been waiting for. It is a short-waver designed specifically for the short-wave listener who desires to search the ether from top to bottom. Everything has been done to combine high efficiency with ease of control. The coils are not wound on plug-in formers, but a simple switching system is used, which is easily within the capabilities of the average set builder. A large dial is included, which you can calibrate yourself, and there is also a built-in beat oscillator for the reception of Morse Code. Its performance is of the highest order, and its tonal qualities quite the equal of any broadcast set. You are certain of thrills, with your Senior Seven.

hen the average man gets hold

these and other reasons, we the problem of the straight wave set with only one thing d—how to give the listener the sible selectivity and sensitivity, tiv least complication of controls.

COVERAGE

d on from the above remarks, uay something about band

he popular bands among short- jers are those at 16, 19, 25, and Probably 90 per cent. of ing is done on those wave-

ere it will be a great advantage one set of coils which will n without the need to change er set.

ext most important band is that above 31 metres, extend- 100 metres or so. There is the es band, as well as stations round 70 metres. In addition, the band at 40 metres makes good g, as also does the band at 20

16 metres is a bit of no-man's present, except for the 13 metres isions, which often come through ch.

ver, it isn't so easy to make sets efficiently below 16 metres, as broadcast-set designers have With careful tuning, it is pos- de quite well in these regions. len w falls off very rapidly, par- below 13 metres.

set ourselves the task of pro- e band which will end about and go down to about 10 with a bit of luck; a second, and important band, which will 16 to 16 to 40 metres; and the running from 40 metres to 0 metres.

OR PLUG IN?

me to the old problem of versus plug-in coils. Once e cast a vote in favor

THE SENIOR SEVEN

PARTS LIST

1 Chassis, 14 x 12 x 3½.
1 Front panel, 16 x 12.
Brackets for coil and condenser mounting (see article).
1 Standard Edgelit dial.
3 Midget condensers, 100 mmfds.
2 Midget condensers, 25 mmfds.
4 flexible couplers.
3 Low-gain intermediates, 465 m.
1 Beat oscillator coil, 465 m.
1 Power transformer, 385V. at 100 mills., 5V. at 3 amps., 6.3V. at 3 amps.
1 .5 meg. potentiometer. VOL. control
1 50,000 ohms potentiometer. D.S.C.
2 "On-Off" switches.
2 8 mfds. electrolytics.
2 25 mfds. electrolytics.
2 .5 mfds. tubular condensers.
2 .1 mfds. tubular condensers.
5 .05 mfds. tubular condensers.
1 .0005 mfds. mica condenser.
2 .0001 mfds. mica condensers.
2 1 meg. resistors.
2 .5 meg. resistors.
2 .25 meg. resistors.
1 15,000 ohms resistor.
1 10,000 ohms resistors.
1 3000 ohms resistor.
1 400 ohms W.W. resistor.
1 100 ohms W.W resistor.
1 25,000 ohms voltage divider.
9 coil forms for coils (see text).
1 3-section w/change switch (see text).
Sockets—6 octal, 1 4-pin.
Valves—2 6U7G, 1 6G8G, 1 6C8G, 1 6V6G, 1 80.
Speaker—1500 ohms F.C. matched for 6V6G.

of switched coils, for the following reasons:—

The short-wave listener should be asked to plug in and [illegible] coil [illegible] time he [illegible] wants [illegible] as he will [illegible] some time be [illegible] But the short-wave listener should be able to jump quickly from one frequency to another with the minimum possible waste of time. Any coils which are nine coils to be handled are so easily mislaid or damaged.

Secondly, in those days of switches we don't [illegible] In the tuning coils [illegible] must be remembered that it is the coil actually in the tuning circuit that matters, and it doesn't matter nearly so much if we should have to use longer leads running to the coil plates from such coil.

Not that any lead in this set is longer than they should be. The position of the coil unit right under the gang, and the close proximity of the coil to the gang itself, allows the leads to be well within reasonable limits.

EASY CONSTRUCTION

It may be thought that it is easier to make a set using switched coils than one using plug-in coils.

After a good deal of experimenting with both types, we cannot agree that this is so.

If you glance at the circuit diagram you will see that each coil has only two leads to be switched. One coil has the lead to the aerial and the lead to the grid of the R.F. valve. The converter has the plate lead from the R.F. amplifier, and its own grid lead. The oscillator section has only a plate and a grid lead to switch. The returns of each set of coils are connected together, and make contact to the same respective points in the circuit.

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So that it isn't really much harder to connect leads to the right switch points than it is to connect leads to valve sockets for plug-in coils. The coils themselves are mounted against their supporting shields, and the ends of the coils are soldered directly to the switch points. As our diagrams will show, a little extra dexterity with a soldering-iron is all one requires.

The connections may be unusual to anyone accustomed to plug-in coils, but certainly they are not difficult. We will have more to say about the coils later on.

HAND TRIMMERS

One of the difficulties associated with switched coils is the problem of tracking. Now, we don't suggest that the home builder could easily make up a tuning-box, trimmed and padded, to keep perfectly aligned over each band. That is a job which requires a good engineer and his factory to do it properly.

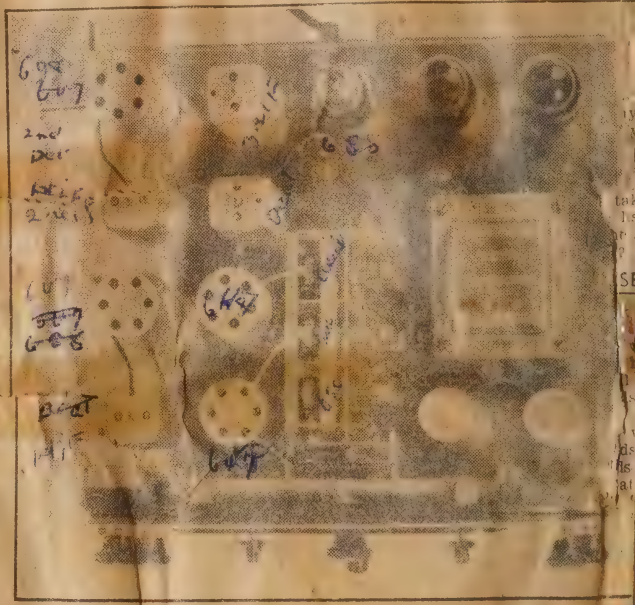
But there is a very simple way out of the trouble, and one which is actually more efficient than the trimming and padding.

It is to supply a pair of variable midget condensers connected in parallel with the main tuning sections for the aerial and R.F. circuits, so that, at any spot on the dial, these circuits can be brought into perfect tune by hand adjustments from the front panel.

The coils are would so that they start off on an even tracking with the tuning condenser all out. As the are gradually meshed, more cap required in the first two circuit in the oscillator, to maintain th ference between these circuits e the intermediate frequency. To the hand trimmers are incre capacity in step with the main condenser, so that when this latt denser is full in the hand t have their maximum capacity in also.

Resonance for these hand tri is indicated either by the st signal, if tuned to a station, or highest hiss level, indicating sensitivity, if not. It's a very matter, and the operator may b of obtaining perfect alignment where he is likely to tune.

The net result of using the switching, with the hand tri that we can flick from band at a second's notice and bri into line at every spot.

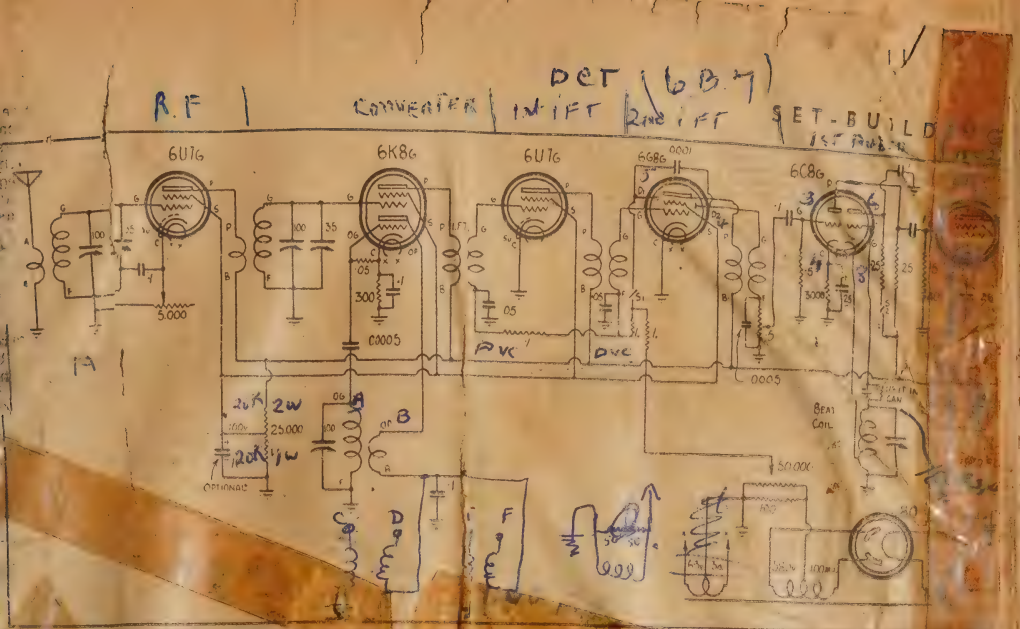


The set from the top. The valve connected to the middle section is The front gang section is the oscillator. The valve nearest the centre of the the R.F. amplifier. The first I.F. transformer is at the bottom left, then k first I.F. valve, second I.F.T., 6G8G valve and round the corner, the third I.F.T. The positions for these components is not critical.

THE CIRCUIT

So much for the coils ... which will be given later ... now have a look at the circuit.

First of all there is ... At least one such ... order to give good ... as well as to reduce ... to a minimum. The ... 6U7G, which operates ... quencies when we ... Many amateurs ... on this stage in ...



The circuit of the receiver. The use of a .1 mfd condenser from the 100 volt tapping is a good idea where voltage fluctuations are likely to occur.

tivity. This is all very well in its way, but has its disadvantages. On the whole, we prefer to get gain by good design of the stages rather than to use regeneration. The amateur whose very life depends on reading tiny signals which are down in the background noise can often get through with regeneration, but most short-wave listeners could never phone stations as weak as this, nor would they want to.

To make regeneration worth while on such a set as this, so much extra would be required in the matter of control that we don't think it worth while. Moreover, it would be almost impossible to achieve smooth and satisfactory regeneration when covering a 2-1 frequency ratio. In our considered opinion, we are better off without it. It is interesting to note that practically all the better-class commercial short-wave sets, of which U.S.A. is the home, shun regeneration in any form.

Instead, we have provided a sensitivity control of the R.F. stage, independent of the A.V.C. line. Our experience has shown that it is better to leave both the converter and R.F. valves operating at their best all the time. The only occasion when control of the R.F. valve is necessary is when there is a very powerful signal coming in which might overload the valve unless it is backed off.

We have included a variable bias resistor which allows us to ease off the gain when required, or to bring it right up to the very maximum when weak signals are to be found.

The R.F. stage will often show signs of being regenerative when nearing its best condition, we can be satisfied that we are getting the best gain

THE CONVERTER STAGE

The converter valve. We have used the 6K8G as being the best

we have already pointed out, it is not connected to the A.V.C., and runs at a steady three volts bias at all times. Thus we avoid any danger from frequency shift which might take place under control. As a further precaution, oscillator plate and the screen are fed from the same voltage resistor to maintain tension. Varying the voltage on either of these terminals to the frequency slightly in opposite directions but they both vary together, the net result is no noticeable shift.

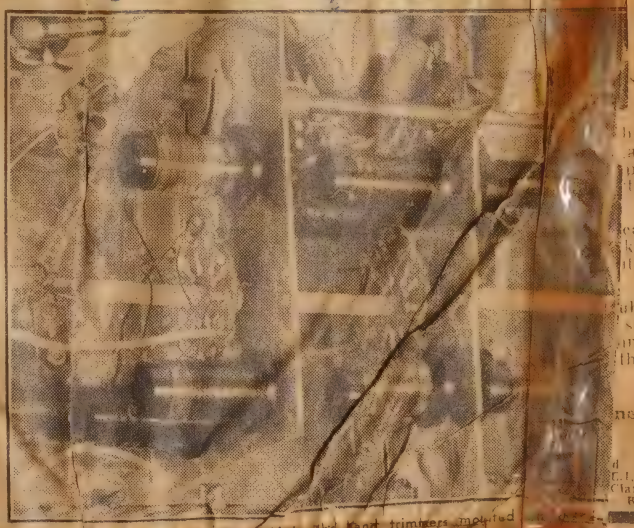
Otherwise there is nothing unconventional about this stage. We prefer

the [illegible] such a set to oscillator, apart from by using it.

THE INTERMEDIATE

There are two intermediate [illegible] using [illegible] one I.F. stage is [illegible] extra stage and using mediates, we don't add a [illegible] the overall gain when [illegible]

A COIL CLOSE-UP



A close-up of the coil and [illegible] Note the band trimmers mounted [illegible]

...ET BUILDING

...high-gain stage, but we do materi... improve selectivity. You will find ...good short-wave sets doing exactly ...same thing for exactly the same ...

...ere is no trouble in stabilising the ...stages.

...have used A.V.C. on these I.F. ...s, as experience with such sets ...shown it to be most useful here. ...are faced with a different set of ...tions from those of the dual-wave ...and the A.V.C. is required mainly ...l leveller. It automatically adjust... ...eak strong and weak stations. In ...ost cases we have found this practice ...atisfactory that we have adopted ...re once again.

...6G8G

...e first I.F. valve is a 6U7G, and ...second is 6G8G. This latter valve ...equivalent of the better-known ...but it has an octal base.

...is valve has a pentode section ...we use for an I.F. amplifier, and ...diodes, one of which we use for ...tion and the other for A.V.C. The ...ode section has a little less gain ...the 6U7G, but, as there is so ...anyhow, this doesn't worry us.

...LIFIER, BEAT-OSCILLATOR

...we come to the 6C8G, a twin ...which is used as first audio ...and beat-oscillator.

...use of this valve for such a ...e is our old scheme once again. ...saves using another valve for beat-...lator.

...beat-oscillator is, of course, used ...allow Morse code signals to be ...d. Not every short-wave listener ...s Morse signals, but no good short-...set would be complete without one. ...Sooner or later, someone may want ...listen to such stations. It is also ...handy to locate weak carriers, as ...sets a "whistle" on each one when ...switch is snapped "on."

...grid of one triode section is ...ected to a cap at the top of the ...ope—this is the one used for the ...amplifier. It has a gain of about ...and coupled to the sensitive ...ne, enough output to satisfy ...

...A.V.C. CIRCUIT

...attention may ...t, which is drawn to the A.V.C. ...little out of the ordinary. The usual method of obtaining A.V.C. is to use a diode somewhere, hitched to the grids of the controlled valves through decoupling resistors. The use of cathode resistors, suitably by-passed, provides a minimum bias for the valves under no signal conditions.

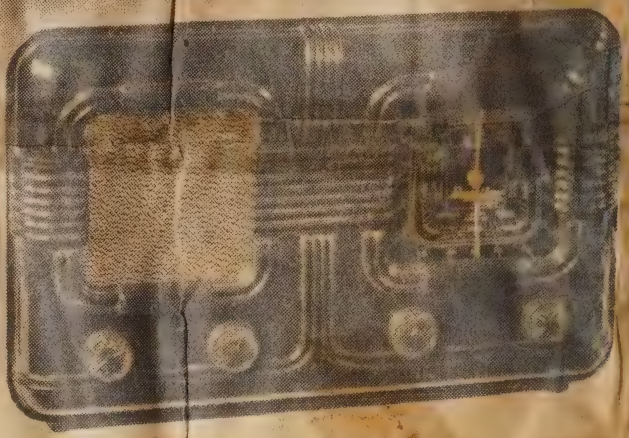
In many cases it is desirable to use the set with no A.V.C. at all—nearly all short-wave receivers have a method of switching it out if desired.

In order to allow an easy sensitivity control which is equally effective whether A.V.C. is in or out, we have done away with the cathode resistors and used, instead, a back-biasing system wh... supplies negative vo... gri... stead of positive ... cathode.

This allows all the ca... hodes of the valves to be earthed—in... tself a good point. Many of the l... tle annoyi... bothers about such set... are due the fact that cathodes ar... not at ea... potential.

The bias for the 6V6... —namely, ... volts—is obtained in the usual back biasing circuit. Across the bias re... sistor is wired a potentiometer of 50... ohms. The moving arm of the potentiometer is connected to the A.V... line, as shown in the circuit.

5 VALVE SUPER DUAL WAVE £10/5/-



FEATURES: Bakelite moulded walnut case. Overseas and Australasian reception. Overall size: 14½x8in.x9½in. high. 5 metal and glass latest type Valves. 6½in. Role Speaker. Equilit, easily read glass dial, with stations marked clearly. Control Knobs: (1) Tone (2) Volume (3) Stations (4) Wave Change. Chassis Guaranteed 1 year. Valves Guaranteed 90 days.

¶5-Valve Dual Wave, as illustrated . . . . . £10/5/- cash

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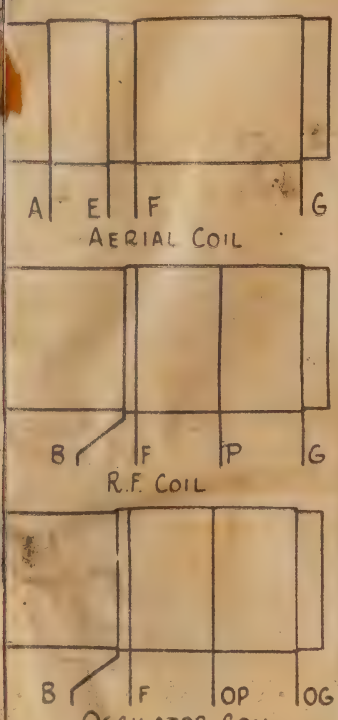
using this control we can bias I.F. valves anything from u[illegible]6 . and this bias is irrespe[illegible] current drawn by the valves. If A.V.C. switch is desired, it is wired as to break the connection between A.V.C. line and the corresponding ie of the 6G8G. Very simple, and ting for the least possible trouble. ncidentally, this sensitivity control is y smooth in operation and very asant to handle.

LIBRATED DIAL

You will notice that an ordinary edge-tuning dial is used with this receiver.



These sketches show the right connections for the ends of the windings with respect to each other.

aturally, the markings on the dial at is are not much use. But, when e set is built, the constructor places thin sheet of cardboard over the asses, having previously drawn on it me semi-circles in which to mark e positions of his stations. He can ow proceed to calibrate this dial himself, marking in the positions of the rious bands and any other odds and ds he may find useful. He can fill in e calibrations with ink at a later date, he so desires, and, of course, any s made with a soft pencil can easily bed out.

e use of such a dial is a necessity any good set, and the builder can ure that the accuracy of the markwill depend on the trouble he takes

Rola 6-15, the most efficient six-inch permanent magnet speaker ever made available to set builders.

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High quality. Having an exceptionally wide frequency range, these speakers give pleasing upper and lower note response and impart truly fine quality of reproduction to small and portable sets.

Reproduce loud signals with ease. Not easily overloaded, these speakers will comfortably handle the output of standard output valves.

Light, robust, compact and trouble free, they are ideal for portable sets. Their wide use by manufacturers for this purpose recommends them to every builder of small sets.

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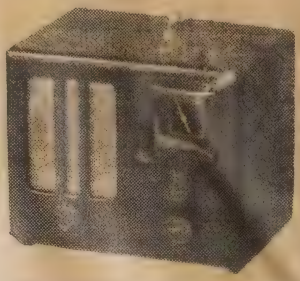
AND

Senior Seven Short-Waver



4 39 Mantel—Everything you need for this receiver you can get from John Martin.

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CERAMIC SHORT-WAVE MICROVARIABLES

RAYMART Microvariables were used by the Technical Editor for the construction of the Senior Seven Short-Waver.

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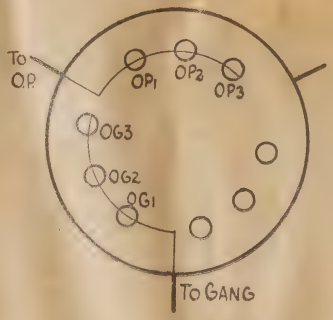
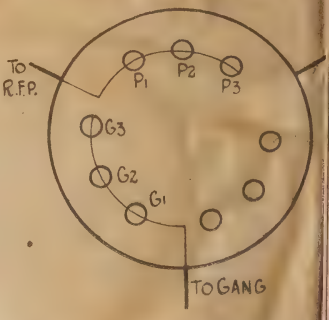
116-118 CLARENCE STREET, SYDNEY.





The switch connections are made as shown in these diagrams. One section on each is left unused.

o get them right. It is an easy job, nd infinitely to be preferred to messing bout with graphs and calibrations harts wherever he wants to find out where he is.

Good dials are obtainable quite heaply, and probably will cost no more han panel types marked with a 0-100 legree scale.

THE COILS

The coils are wound on formers 1in. n diameter. Each coil will need about wo inches of former, so if you buy a couple of feet you will have plenty to allow for mistakes, &c.

They are wound just like any other coils, with long leads left for connection into the circuit. The ends of the windings should be kept well away from the metal partitions, so start the grid ends right at the ends of the formers.

The coil data we give here should make a fine starting point, and the exact adjustment, as with plug-in coils, may call for a little pruning of a turn or two here and there, to make the coils all start off together, at the right wavelength.

We used Trolitol formers as used in standard dual-wave sets—these formers may be bought at some shops, but any good former will be suitable. Several methods of mounting suggest themselves —the obvious one being to make a litt bracket for each. Any bolts and nu used to fasten the coils in place shou be of brass, not steel.

Little difficulty will be found keeping the switch in line. The bank can be mounted directly to the par titions, or the switch can be built u with the extension pieces for each side are easily obtainable to give standar spacing.

Three banks to switch three poin into three positions, are required. is a good idea to get banks which sho out the coils not being used. A dealer can inform you on these point

When the coils are wound, they c be fixed in place with a light coat clear lacquer, or duco cement. Th

materially affect the efficiency, and keeps the windings firmly in place.

Where a doublet aerial is used, the earthed ends of the aerial coils are connected together, and wired to a second aerial terminal.

When anchoring the ends of the coils which are connected together, you can use some of the lugs on the switch which are connected to the unused section. This may help to avoid tangling wires. There is no reason why a neat job should not be made of the assembly, if the leads are all kept short and direct in their connections.

TUNING CONDENSER

It is permissible to use either a three-gang condenser as we have shown in the picture, or three midgets ganged together. The first method is handy, but the second works equally as well. Three gang condensers of .00012 or .00015 mfds, are obtainable at city stores, or a standard broadcast gang, with all but four moving plates removed, can be used. The rotor is taken out of the frame to remove these plates. The bonding piece at the tip of the plates is cut before any plates are pulled out. If this is done, a perfectly satisfactory job is possible, particularly as we don't have to worry about exact tracking of each section.

The midgets if used, should have a capacity of 100 mmfs. (.0001 mfds.) or more. The larger condensers will cover a bigger band on each set of coils.

Our gang was of .00012 mfds. capacity, and it ranges from about 10 to 19 metres on one set, 15 to 40 metres on the next, and 40 to 100 on the third. You will see even with .0001 mfds, there will still be enough coverage for continuous coverage from top to bottom. After all, it isn't necessary for instance to tune 40 metres on two coils, as we can easily do at present.

The midget trimming condensers should be 35 or 50 mfds. The 35 type may not allow you to keep the coil fully in track over the 40 to 100 metre band, although they don't peak as critically as the 50 type. If you use 100 mfds. midgets for tuning, then 35 will be enough for the trimmers. If larger condensers are used, make these 50 mfds.

There is little more to be said about the set. Spend a little time on the coils, adding or removing turns from the secondaries so that you can peak the trimmers at the bottom of the reading for each band, with the plates almost out of mesh. If the trimmers need to be meshed too far, add turns to the secondaries. If they are at a minimum before the tuning condenser remove turns. There is no trimmer on the oscillator section. The number of turns on these oscillator coils will determine where your bands will start and finish. If you want to move 16 metres for instance, nearer to the all-out position, add turns to the oscillator secondary, and vice-versa.

COIL DATA

The coils which may need a little pruning for individual sets are the secondaries. The following turns are suggested for a start. They are not critical, as the hand trimmers allow you to match them, even though there should be big differences between them.

Secondaries—40 turns of 22-gauge colse-wound for 40-100 m. Fourteen turns of 22-gauge half-close and half-space for 16-40 metres, and 5 turns space-wound of 18 gauge for the third range. All coils about 1¼ inches in length.

Aerial coil for 40-100 m has 6 turns at the bottom end of the secondary. For 16-40 metres there are four turns interwound. The third coil has 3 turns interwound. Use gauge 30 for these.

The oscillator primaries are wound with 30 gauge wire. For 40-100 m use 10 turns at the bottom of the secondary, for 16-40 m use 6 turns interwound with the secondary, and for the third band, use three turns interwound.

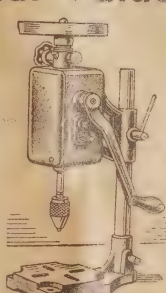
First adjust the oscillator secondaries to make the bands start at the most convenient spots. Then adjust the other secondaries so that with the tuning condensers out of mesh, you can just peak the hand trimmers, when these are also practically out of mesh.

MURDOCH'S

Special Values in TOOLS

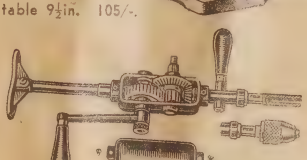
BENCH DRILLERS

These have automatic feed and return. Two speeds fitted with three jaw chuck for round shank drills up to ¼in. Speed regulating screw and dust-proof gears, cut from solid steel. Greatest distance between chuck and table 9½in. 105/-.



POLISHING OUTFIT

Polishing head outfits, complete with cast sawbench, circular saw, vitrified grindstone, wire brush, felt bob and polishing mop, 59/

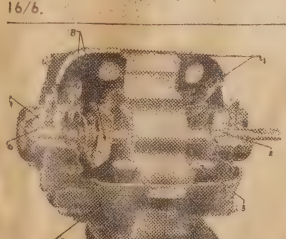


BREAST DRILLS

Body crank and breastplate made from unbreakable, malleable iron. Solid steel gears with machine cut teeth. Fully enclosed gears, 2 speeds, ball bearing. Capacity, 0 to 5/16in. drills, enamelled black, 12/6. Capacity, 0 to ¼in. drills, 16/6.

EMERY GRINDERS

Hand grinders, medium grit stone. 4in. x ¾in. wheel, 7/ 5in. x 1in., 17/6. x 1in., 19/



HOOVER MOTORS

For use only on 240 volt, 50 cycle electric supply. Canadian made, for workshop, home or factory. Economical . . Plug into any power point. Lasting . . Built for continuous heavy duty

1/6th H.P., 1425 R.P.M. £4/10/
1/4th H.P., 1425 R.P.M. £4/10/
1/3rd H.P., 1425 R.P.M. £6/10/

FREIGHT—Orders for above goods under £1, kindly add full freight. Orders over £1 sent half freight paid, per goods rail only.

MURDOCH'S LTD., PARK ST., SYDNEY

N THE AMATEUR BANDS

by A. V. Bennett

ONDITIONS GROW WORSE!

POOREST PERIOD FOR MONTHS

The poor conditions which have prevailed during the last month on the high frequency bands make one feel very pessimistic about the near future. Without a doubt, I would say that last month was the poorest period for short-wave transmission and reception which we have had for a very long time.

' is most difficult to predict or offer any suggestions on the behaviour of the various bands for the coming month. Usual signs and portents e altogether missing, as it seems that are fast approaching that dreaded iod which is to be expected at the d of the eleven year cycle, when stable nditions for good DX on high fre- ency bands will be a thing of the past.

Past feats and performances will then come a favorite topic of conversation, ter the style of fishing tales, and will sibly be attended by the same flights imagination, such as "the time we rked the G. with 5 watts input, and e clothes line for an aerial, and got RST 569 report." There will be lemn parades around the QSL cards the wall, mute proof of some of the X "that didn't get away."

With the exception of twenty metres ring the afternoon, when most of us e earning the daily bread, bands have en nearly empty.

It is strange to find forty metres so dead. A few months ago it would have been hard to imagine this band in such a condition. Absence of local interference has made it possible to hear a few weak DX stations. Around 8.30 a few European phone stations have been coming through—mostly French, I think. Weakness of signals makes it difficult to identify the calls.

During the mornings, also, some Europeans are still coming through on forty, also South African—mostly on c.w. This band should improve a little over the next few months, for long distance contacts, during both mornings and evenings, and possibly will take the place of ten and twenty metre bands for DX work. Of course, twenty metre W. phones will still be there, but it is becoming increasingly difficult each week to make one hundred per cent. contacts with them, even though in most cases they are using around a kilowatt, plus a directive array.

TEN METRES: BEAM AERIALS

Ten metres has not changed during e month. Eight to ten-thirty in the orning is a stable period. American hones are numerous, but with the ex- ption of a few strong K6 signals there as been very little else. Ten is still week-end band for the majority, but eems to be making an effort to open up the more convenient hour of 7 p.m. Signals can be heard then, though ot very strongly. Ten may make a hort recovery, and possibly we will be earing a few Europeans in the even- ngs. Possibility of a ten metre W.A.C. eems remote these days. The achieve- ent would require many hours of atient listening—possibly a twenty-four our operating schedule over a few eeks would accomplish something.

Speaking of beam aerials—when the forty metre band does open up there will be some headaches and heart-burnings in the erection of beams for this band. Unfortunately, those required for operating on lower bands become a little cumbersome at times. Let's hope they will not be needed, and the old twenty still performs well enough to give some return for the labor and expense which have been put into so many fine antennae in use at present in VK.

Interstate stations, as well as overseas, have been affected by bad conditions. Severe fading and complete fade-outs have been prevalent most of the time. Strongest and most regular signals in Sydney have been from Queensland.

TWENTY METRES

Very little change will be noticed on 20 during the next few weeks. The only improvement to be expected is that the band will probably hold up from about 4 to 8 p.m., and signals around 10 and 11 p.m. will be a little stronger.

An outstanding American phone station last month was W2ZC. Running 800 watts and using a 16 element curtain array for both transmitting and receiving, his signals were strong from early afternoon until about 9.30 p.m. our time. The beam is directed towards Australia, and can be centred on Mackay, Queensland, or Sydney, N.S.W. This is not accomplished mechanically, but by separate 600 ohm line feeders, which introduce a phase difference in the curtains. W2ZC claims a gain of 20 to 1 in his array.

Beams again—VK4MW uses a W8JK for transmitting, and a rotary two element for reception. To lure the signals in, Marv dashes out into the yard and manoeuvres the array, with an ear cocked for the improvement or otherwise in signals from the shack.

VK4PF seems to be working quite a few Europeans on phone. Judging from the fine business signal he puts into Sydney, it should sound good on the other side.

South American and Asiatic stations have been scarce on 20 phone, although there have been a few on the high frequency end of the band, on c.w. Most consistent K6 station is still K6MVA, but he has not been working many VK's —mostly W's "on the mainland," as Americans in Hawaii term it.

Conditions between KA, K6, and U.S.A. are very good at present. During the coming weeks there will be improvement in peak periods on 20 metres, but these will not be reliable, and between peaks operation will have to be confined to local chatter.

An American yacht signing KLI6, on 14,350 kc, is working Americans, and on the look-out for Australian contacts.

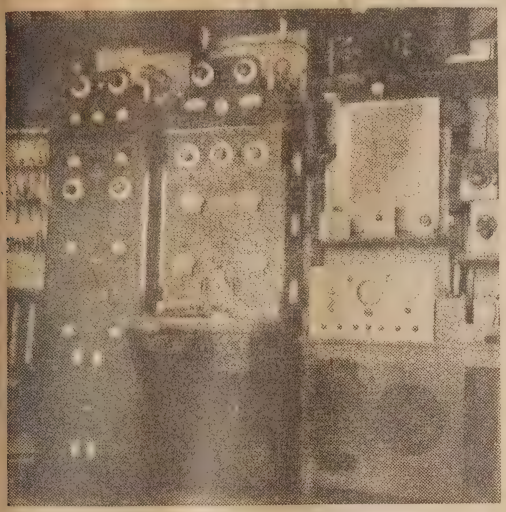
FN1C was worked by a few Sydney amateurs a couple of Sunday mornings back—time 8.30.

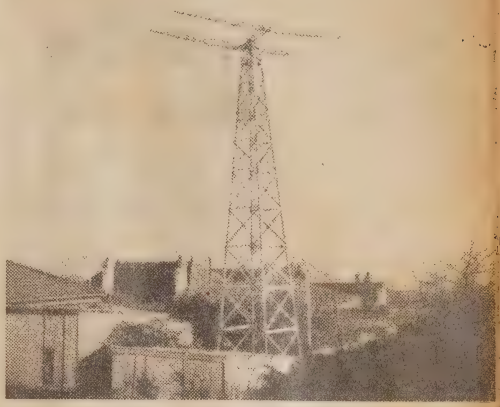
G2PU is consistent and strong on phone during early mornings and late afternoons.

YR5ML, on approximately 14,280 kc, has been coming through well during afternoons around 5 o'clock, with a fair note. A YR contact is in Zone 20.

VK2AGU has now had 45 consecutive contacts on phone with G3GQ, around 7.50 in the morning. Seems like an Australian-English record.

STATION AND BEAM AERIAL AT VK2AGU





The photos show two views of VK2AGU's outfit; his rig, and beam aerial. The rig on the left of the photo of the shack is used for 20, and the rig on the right for 10 metres. Both rigs use an 809 in the final, running 50 watts input.
The beam is supported on a 41ft. tower, and is rotated by means of a reversible 1-6th horse-power electric motor, using a gear ratio of 600 to 1. 2AGU boasts of two operators, as Harry's son Ken also has his ticket.

SENSATIONAL CONTACT On 5 Metres

ENGLAND CONTACTS ITALY

Some very good news is to hand regarding five metre work in Europe. G8GQ contacted and QSO'd 11KM on phone at 1500 G.M.T. on 26/639, and received QSA 3, R4. The contact was continued until G2GQ's signals were lost by 11KM. This is indeed an outstanding performance on five metres, and promises well for the success of amateurs operating on this band.

G8GQ is using the following: Antenna —4 element, horizontal array, 28 feet above ground. The four elements are: One reflector, two directors, and a radiator. The rig—AFP 4C osc.—6L6—6L6—RK34—using 35 watts input. Receiver—Acorn RF. triode, hexode, two intermediate frequency stages, 1600 kc diode, and one audio, using earphones. The excitement caused by such a contact can well be imagined. It is the second contact between those two countries.

ZL STATIONS STRONG ON 80m. AMERICANS ALSO COMING THROUGH

Eighty metres has been giving good results, and is still showing improvement. ZL and interstate stations are strong, and during the evenings 80 seems to be the busiest of the amateur frequencies.

Large amounts of power are not required on this band. Using a small portable transmitter with 5 watts input, R6 and R7 reports from New Zealand were received. The antenna used was 130 feet of wire coupled to an aerial tuning circuit, average height of antenna being only 7 feet from the ground.

Excellent work was done by VK2BN on 80 metres. Reg contacted two Canadian phone stations, VE5OT and VE5GQ, reports being Q5, R7 each way. VE5OT will be remembered for his consistent signals on 20. 2BN's antenna was a 66ft. 6in. vertical, used as a quarter-wave grounded Marconi.

AMERICAN CONTACTS

W stations are strong on this band. New Zealanders work them consistently, and VK2EQ, in Sydney, has had his share. 2BQ uses a half wave Hertz antenna, which is also used as two full wave lengths on 20 metres—a very good all-round antenna for the three bands, 20, 40, and 80.

VK3's are active on 80, the sector used for R.A.A.F. reserve being very busy with their traffic.

QRM must be very severe on 80 metres in U.S.A., this band being very popular with W's for phone operation. Possibly local U.S.A. QRM is one reason why so few VK's get through on 80. Also, the benefit of the skip is not enjoyed in this direction.

LAKEMBA ACTIVE

The 80 metre band has been put to good effect by members of the Lakemba Radio Club. Co-operating with the Search and Rescue Section of the Bushwalkers' Federation, tests have been carried out using light portable gear and a small control station, which was in contact with the city. The idea behind the tests is to assist search parties looking for people lost in the bush, to keep in contact with each other. A successful test was carried out recently in the mountains near Glenbrook, the only drawbacks being extreme cold and a mishap or two to some of the members' cars.

Round the Trade

NEWS AND NEW RELEASES

ROLA RELEASE 6/15

ILLUSTRATED here is the latest Rola Permagnetic Speaker, known as the type 6/15.

It is a particularly efficient speaker suitable for battery receivers, where a small speaker is required, which at the same time will give highest output for a given input.

In this connection it is particularly suitable for receivers using the 1.4 volt type valves. It is small enough to be used in the average portable receiver, for which it is bound to be very popular.

It is available in all the standard input impedances.

We have received the following communication from the factory :—

"Advantage has been taken of the slight delay caused by orders being banked up at the factory to circulate rumors designed to prejudice or injure our good name. Knowing that no manufacturer of components can truly serve an industry when allied to any one section thereof, we have remained strictly independent of all affiliations with radio set manufacturers or the personnel thereof. Any rumors to the contrary are entirely without foundation."

The new Rola 6/5 permagnetic.

FINE OSCILLATOR FROM PATON ELECTRIC

Paton's latest oscillator is obtainable, with or without output meter, for battery, A.C. or vibrator operation.

A POPULAR modulated oscillator, which shows every sign of becoming an even better seller than previous models, has been placed on the market by Paton, of Ashfield.

The model shown here, which is similar to the one we have acquired for our own use, is fitted with an output meter, which will read three ranges of output volts, for making comparative measurements.

This meter reads in three scales, with a maximum of 100 volts. It uses a valve rectifier, and the ranges are selected by the switch in the left hand bottom corner of the panel.

The switch turns on the A.C. power, selects either a C.W. signal, or one modulated 30 per cent. with a 400 cycle note, and controls the output meter.

Practically continuous coverage is given from 24 megacycles to 160 kc. in six steps selected by the switch second from the left. The third switch is the attenuator control, and the fourth gives four different output intensities.

The output plug is at the bottom right hand corner of the panel. Leads and dummy antenna are supplied.

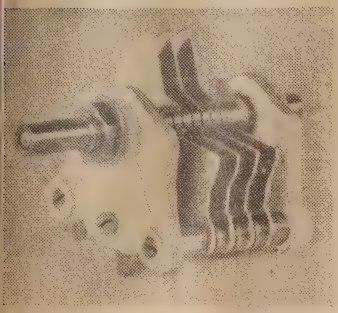
We have found the oscillator accurate, and thoroughly satisfactory in all its ranges. Write to the Paton Electrical Pty. Ltd., 90 Victoria Street, Ashfield, or enquire from your dealer.

R.C.S. HAS NEW LINES

MIDGET CONDENSERS—COILS

1.4v. VALVE RESISTOR

Several new lines are released by R.C.S. radio, and are shown in the photographs below. These include many new coils, both intermediates and tuning coils, special midget condensers, and a resistor for use with small 1.4 volt sets to prevent over-running filaments on new batteries.



An R.C.S. 35 m.m.fds. midget condenser, doubled spaced with Trolitol end plates.

THE use of Trolitol insulation for R.C.S. products has been carried throughout the full range of components, wherever such insulation may be employed.

In the new range of midget condensers, we again see Trolitol as the material used for the end-plates. The quality of this material allows the condensers to operate with high efficiency in circuits where the very best is required.

Apart from the standard type, R.C.S. make a special 35 mmfd. condenser which should be very popular among builders of small transmitters. These condensers were originaly made for the 5-metre transmitter described in last month's issue, in which they proved particularly efficient.

The plates are double-spaced to give good protection from flash-overs and extra accuracy.

As will be seen, they have a spindle supported by a plate at each end so that they may be ganged, if required, by the use of standard extension pieces. One hole mounting is used.

A resistor made for use with 1.4 volt valves.

Note the Trolitol former used in all R.C.S. coils from now onwards.

STANDARD TYPES

The same design is used in a standard range of capacities, varying from 15 mmfds. to 100 mmfds.

Then there is the Star type, for use where ganging is not necessary. This condenser has a spindle support from the single front plate, also of Trolitol and is obtainable in capacities up to 100 mmfds.

RESISTOR FOR BATTERY SETS

It has been found that when the A battery used for 1.4-volt valves is new, the voltage is a bit too high for the maker's ratings. In order to protect the valves against damage over this initial period, it is advised that a small resistor be placed in one filament lead to bring the maximum voltage applied within the maker's specifications.

R.C.S. have therefore produced a special resistor of .25 ohms, which value will be suitable for a set such as the R. & H. portable receiver. It is wired in series with one filament lead, and may be left permanently in circuit.

The voltage drop is very small, and although important when one battery is high, is not so important when it is running low. Its effect on battery useful life, therefore, is not very great.

Set manufacturers have indicated a desire for a cheap coil, and to fulfil this demand R.C.S. have designed new low impedance type coils, which are honeycomb pie wound on new Trolitol formers to be used in conjunction with type IF107-3 air core intermediates.

The coils provide excellent sensitivity at high frequency end of dial, but fall off slightly at low frequency, but not to a degree as to make unsatisfactory. This feature is in contrast to the high impedance type E282 coils, which provide a sensitivity of approximately one microvolt over the entire band.

These coils are peculiarly adapted to manufacturers' requirements, as apart from the excellent R.F. results to be obtained, they contribute to a reduction in labor costs in production of the chassis. The coils may be mounted over the conventional chassis holes, as the 4in. mounting screws are spaced 1¼in. centres apart, but only one inch hole in the chassis is required.

The codes for wiring, in both letter and numbers, are moulded in the Trolitol base, thus assuring accuracy and rapidity in wiring into the chassis.

Also provided in this series is a new shielded Reinartz coil, and an R.F. coil with reaction. These are wound on Trolitol formers, and replace the old bakelite types.

COLOR CODES

Color codes for R.C.S. coils are given here.

ALL AERIAL COILS
4-pin B/C & S/W.

No. 1 or G.—Grid.
No. 3 or F.—A.V.C.
No. 4 or A.—Aerial.
No. 6 or E.—Earth.

ALL R.F. COILS AND INTERMEDIATES
4-pin B/C & S/W.

No. 1 or G.—Grid.
No. 3 or F.—Earth.
No. 4 or P.—Plate.
If primary tapped, No. 5.
If secondary tapped, No. 2.

ALL OSCILLATOR COILS
4-pin B/C & S/W.

No. 1 or G.—Grid.
No. 3 or F.—Padder.
No. 4 or P.—Plate.
No. 6 or BX—H.T.

S. W. TUNING CHART

13 METRES

No stations now audible at entertainment level.

16 METRES

Few stations now audible at enjoyable level.

19 METRES

DJB, Berlin, 19.74 m.—Excellent in the afternoons from 3.5.

DJQ, Berlin, 19.63 m.—Also very good at the same time.

DJR, Berlin, 19.56 m.—Best between 1.0 p.m. and 2.0 p.m.

GSO, Daventry, 19.76 m.—7.20 a.m. onwards, till 9.0 a.m.

GSF, Daventry, 19.82 m.—7.30 a.m. onwards, till 9.0 a.m

GSI, Daventry, 19.66 m.—3.0 p.m. till 5.15 p.m.

2RO6, Rome, 19.61 m.—6.0 a.m. till 8.30 a.m.

YDC, Bandoeng, 19.8 m.—9.0 a.m. Also 10.0 p.m. on.

25 METRES

GSD, Daventry, 25.33 m.—3.0 p.m. till 5.15 p.m.

DJD, Berlin, 25.49 m.—1.0 p.m. till 2.0 p.m.

XGOY, Chungking, 25.21 m.—7.0 a.m., also 9.0 a.m.

RADIO SAIGON, 25.47 m.—Some nights at 11.0.

SBP, Motala, 25.63 m.—6.30 a.m. till 7.15 a.m.

RNE, Moscow, 25.0 m.—7.0 a.m., also early morning 3.0.

31 METRES

W6XBE, San Francisco, 31.48 m.—3.0 p.m. till 6.0 p.m., also 10.0 p.m. till midnight.

GSB, Daventry, 31.55 m.—Best in afternoon till 2.30 p.m., also from 3.0 p.m. till 5.15 p.m.

TAP, Ankara, 31.7 m.—6.30 a.m. till 8.0 a.m.

2RO3, Rome, 31.13 m.—6.0 a.m. till 6.0 a.m.

VPD2, Suva, 31.46 m.—9.0 p.m. till 10.0 p.m.

XEWW, Mexico City, 31.57 m.—2.0 p.m. till 3.0 p.m.

KZRM, Manilla, 31.35 m.—7.30 a.m., also 10.0 p.m. onwards.

41 METRES

TPB11, Paris, 41.21 m.—7.0 a.m. till 8.15 a.m.

CSW8, Lisbon, 41.30 m.—7.0 a.m. till 8.0 a.m.

YDX, Medan, 41.55 m.—9.15 p.m. till 11.15 p.m. and later.

RADIO BURGOS, Spain, 41.6 m.—6.30 a.m. till 7.30 a.m.

49 METRES

SBO, Motala, 49.46 m.—7.15 a.m. onwards.

CR7AA, Lourenco Marques, 48.88 m.—6.0 a.m. till 7.0 a.m.

RADIO SAIGON, 49.05 m.—10.0 p.m. or earlier onwards.

ZHJ, Penang, 49.25 m.—9.0 p.m. till 11.40 p.m.

KZRM, Manila, 48.86 m.—8.0 p.m. or 9.0 p.m. onwards.

OVERSEAS BROADCASTERS

WHAT are generally called the "local" short-wave stations have again been very well received during the last month, and readers who only possess moderately sensitive dual-wave sets will have had no difficulty in choosing varied programme items from many different stations.

U.S.A.—A very welcome addition to the already popular 10.0 p.m. session from W6XBE on 31.48 m. is the new transmission, which commences at 3.0 p.m. and continues until 6.0 p.m. Strength of signals and clarity are equal to that given in the later transmission.

INDO-CHINA.—On some nights from about 11.30 Radio Saigon on 25.47 m gives an excellent transmission in English. All announcements are by a lady, and can be followed perfectly.

PORTUGAL.—In the early mornings on 41.3 m the new Portuguese station, CSW8, can be heard at very good strength. On Sunday mornings announcements are in English, when the lady announcer gives lengthy talks on the various attractions of Portugal as a holiday resort, stressing the fact that it is a land of peace.

GERMANY.—The ever-popular German stations are still being heard at very good strength during the daylight hours, and a very pleasant afternoon's music can be tuned in through DJB on 19.74 m. Despite the difference of opinion between the European countries, music still remains apart from these differences, as evinced by a programme we heard from Berlin entitled "Music of Our Neighbors."

FRANCE.—As mentioned elsewhere, the French authorities have recently been testing a new transmitter on 25.34 m, and if the regular programmes are received at the same strength as the tests were, listeners will have another excellent station to listen to.

ITALY.—For any of our readers who may return home in the very early hours (we do not recommend getting up these cold mornings around 3.0, we have tried it!) we suggest a few minutes' listening to the Italian stations both on the 25 and 31 metre bands, which are very good at that time.

AUSTRALIA.—In an effort to conserve space we have not included our own short-wave stations in the "Listen for These" pages this month, but do not think from that that they are not being heard. VLR on the 31-metre band is very good in the daylight hours, being just like a local in Sydney and probably elsewhere as well.

9MI, the transmitter aboard the Kanimbla, can also be heard quite often on the 49-metre band around 10.0 p.m., while, of course, on Sundays VK2ME comes in at very good strength. No doubt our West Australian listeners hear their station, VK6ME, at good level, though it is rather weak now in the eastern States.

By RAY SIMPSON

DAYLIGHT RECEPTION NOW EXCELLENT

IMPROVING CONDITIONS ON 49 m.

All the regular short wave broadcast bands, including the 25 metre one, are now providing excellent reception, more especially in the daylight hours. The very early morning hours being the only time of poor reception.

Nineteen metres has been really outstanding, both in the early morning from 7.0 o'clock, during the forenoon, and in the afternoon until about 4.30. Night time reception has been practically nil, however, on this section of the dial.

A great improvement has been evident on the 25-metre band, where quite good reception can be had in the forenoons, both from the European and South American stations, while at night the Orientals are there in force.

The ever-popular 31-metre band is very good until about 8.30 a.m., again in the afternoons, and also from around 9.30 p.m. onwards, when all the well-known stations can be heard.

NEW 41-METRE BAND

The new 41-metre band is very good in the early morning, when the Europeans are heard, and also at night, when the Eastern stations take their place.

Most noticeable improvement for the month at our location was the 49-metre band, which now is excellent in the early mornings, and also late at night. Noise level seems to be lower, though morse interference is still just as bad.

Quite a number of our correspondents have remarked on this annoying problem of morse interfering with reception, which has been most noticeable on the 49-metre band, and also on 31. While in some cases this may be deliberate, we would point out that many commercial stations have assigned frequencies in the various broadcast bands, and naturally are quite within their rights in using them. While not agreeing with this practice, we mention this fact in fairness to the stations concerned.

MOVE TO SEVEN METRES

Conditions on the U.H.F. bands have been very poor during the last month, and it looks as if we will have to wait until the season opens again before we can expect reliable reception.

From one of our valued readers in the U.S.A., Mr. Perry Ferrell, jun., we learn that the 9-metre stations are now moving down to 7 metres, also that W2XJI will shortly move to 25,300 kc as soon as they get authority from the F.C.C. When this change takes place, W2XUP will change over to 25,250 kc.

The Superior, Wis. station W9XJL, have applied for a station on 26,300 kc with power of 1000 watts. Whether this will be in addition to their present station on 26.100 kc or used instead of it is not yet known.

Our American friend has been listening down on 90.000 kc and 100.000 kc channels for signals, but so far with no result. This is indeed U.H.F. with a vengeance!

Up in Queensland Dr. Gaden has been hearing W8XNU, W6XKG, W4XA and W9XUP, and, according to his letter, some of these are coming in at quite good level, and providing programmes of real entertainment.

W4XA, in Nashville, Tenn., have sent us a comprehensive list of their programme items, practically all of which are really high-class music, and not the more usual dance orchestra type.

Perhaps in our next issue we may have more promising results to report.

Further U.H.F. news just received from Mr. Ferrell tells us that the Echo Park Evangelistic Association in Los Angeles, Cal., have applied for a hundred watt transmitter to operate on 25,300 kc.

In addition, the following station has applied to the F.C.C. for change in frequency as follows:—W9XTA, to 26,000 kc from 26,500 kc. Also a new station, W8XUM, is testing irregularly on 25,250 kc with 50 watts.

WAVELENGTH OR FREQUENCY?

WE WILL SHOW BOTH

We have had several requests from readers that we revert to the method of showing both frequency and wavelength when referring to stations. As this method seems to be more convenient to listeners who use dual-wave receivers marked only in metres, we have decided to show both in future.

This month we received quite a budget of letters from our correspondents which enabled us to list quite a number of stations which we had not personally heard, and by referring to the readers' names after the stations, listeners in the same locality can judge what has been audible in their district.

50 kw FOR W8XAL

The Crosley Radio Corporation station, W8XAL, in Cincinnati, Ohio, expect to have their new transmitter on the air about the beginning of September, and will then also use all of the new frequencies mentioned by us in the April issue, namely, 9590 kc, 11,870 kc, 15,270 kc, 17,760 kc, and 21,650 kc.

As readers will notice, some of these frequencies are at present in use by other U.S.A. stations, but interference will be obviated by so arranging their schedules that other stations are not using these channels while W8XAL is on the air.

Directive antennas will be used directed mainly to South America, and the languages used will be chiefly Spanish and Portuguese. While none of these programmes will be primarily directed to this country, the station is anxious to receive reports on these new frequencies, in addition to their present one of 6060 kc, and advise that all reports will receive a reply.

NEW STATION REPORTING

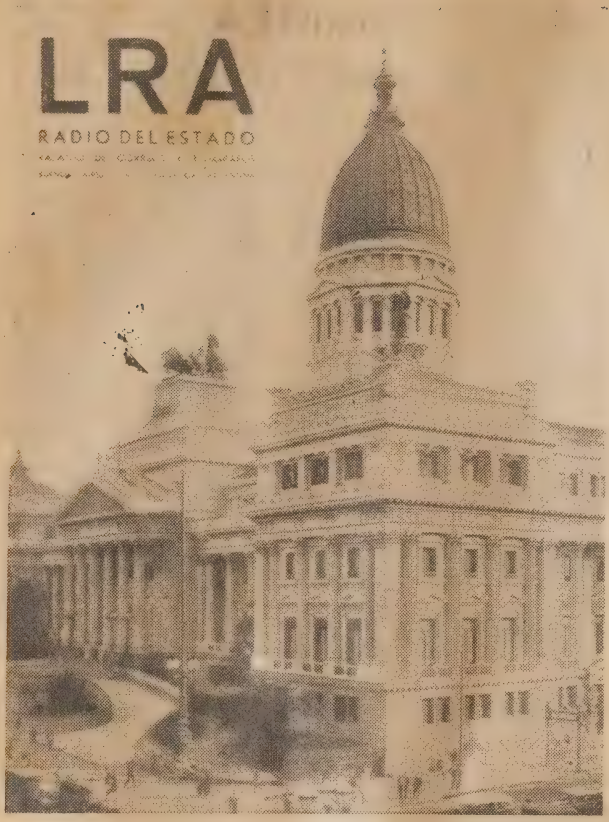
Just a few words with regard to new stations reported by our readers to obviate any misunderstanding which might occur. We have decided that until a new station is reported by more than one reader, with identical details as to location, frequency, &c., it will only be listed in the "Listen for These" section under their name, and not in the New Stations panel. In the case of new stations so far only heard at our own location, these will be entered in the New Stations panel, as we are prepared to accept responsibility for their correctness, having checked them carefully before including them.

NEED FOR ACCURACY

Readers, we feel sure, will appreciate the fact that we wish to keep these notes really authentic, and the above policy, we think, will help towards that end, and at the same time not offend any listeners who may think their new station loggings are doubted. The only other method would be to include all new stations reported by readers in the New Stations panel, followed by their name, which would then later be confirmed or disproved as further reports came in.

We would appreciate comments on this matter from all listeners, and whichever method is favored we will adopt.

A good example in relation to the above is a station which we have heard on and off for weeks past, and which we are reasonably certain is "Radio Bucaresti," in Rumania, but the point is we are not sure, and as it has only been mentioned by one other reader, we are leaving it till it is definitely identified.



The Posts and Telegraphs building in Buenos Aires, which is also the administrative office of the State Radio Station LRA.

This Month's Verifications

COKG.—6200 kc, 48.39 m, Santiago de Cuba. Sent a QSL card with call letters in red superimposed. They show power as 2400 watts and the address is Emisoras Grau, Apartado 137, Santiago de Cuba, Cuba.

W1XKB.—31,600 kc, 9.4 m, Springfield, Mass. From this station we received a letter of confirmation, advising that at the time of reception they were using 50 watts, with antenna on the roof of a 70-foot building. Our report was the first they had received from Australia. They state that they will shortly move to 42,220 kc in the 7-metre band.

WQKC.—31,500 kc, 9.5 m, New Rochelle, N.Y. A very cordial letter was received from Mr. John P. Doege, the chief radio operator, in which he says: "It is the first time this department or any other in this vicinity has received such an amazing report, and it was taken to a newspaper office at once." He would appreciate any other reports from Australia.

KQCF.—31,500 kc, 9.5 m, Tyler, Texas. Mr. B. M. Frazer sends us an interesting letter of verification, saying they would like any further reports from this country, as ours was the first they had received, and interested them very much.

W4XA.—26,150 kc, 11.47 m, Nashville, Tenn. Sends us another letter confirming our report on this new frequency, which was their first from this country, though they had received one previously from New Zealand. Their letter also states that their broadcast station WSM uses the tallest radio tower in America. Their record library contains an extensive range of recordings from all the finest compositions of the great composers. Address is National Life and Accident Insurance Co., Nashville, Tenn., U.S.A.

FLASHES From EVERYWHERE

UNITED STATES.—We learn from the General Electric Co. in Schenectady that their new 100 kw station is nearing completion and when operating will use 6190 kc, 9530 kc, or 21,590 kc.

NORWAY. — Additional frequencies which have been allocated to the Norwegian authorities are LKZ 21,503 kc, LKY 21,467 kc, LKX 17,780 kc, LKU 11,830 kc, LKE 9573 kc, and LKL 6990 kc.

ITALY.—We understand that Italy will shortly take into use 2RO1 on 7220 kc, being one more for this new broadcast band, which very soon will get crowded.

PUERTO RICO.—We learn from Radio News that WKA2 on 9920 kc has been heard operating at 11.0 p.m. E.A.S.T. and has been verified by an American listener. Station is owned by the Puerto Rico Radio Corporation.

CUBA.—The new Cuban station COCE is now operating on 12,230 kc, rebroadcasting CMC. They sign off with an organ selection at 2.30 p.m. E.A.S.T.

NEW ZEALAND.—Watch out for signals from the new Musick Memorial Centre in Auckland, when they commence testing shortly. They will probably carry out tests with the Sydney telephone circuit stations.

ANGOLA.—Listen for CR6AA, Lobito, on 7177 kc or 15,195 kc from 5.30 a.m. till 7.30 a.m. on Tuesdays, Thursdays, and Sundays.

SWITZERLAND.—The Secretary-General of the Societe Suisse de Radiodiffusion advises us that their new station situated at Schwarzenbourg will soon be on the air with regular programmes for each continent, including Australia, and will use 25 kw initially, with ability to increase to 50 kw if this is thought necessary. They will advise us later as to frequencies, hours on the air, &c.

YUGOSLAVIA. — The Yugoslavian broadcasting authorities transmit a transoceanic programme from 10.0 a.m. till 11.15 a.m., usually on the second and fourth Thursday of each month, and in addition to their own station YUA on 6100 kc, also use the two German stations, DJL 15,100 kc, and DZH on 14,460 kc. The latter one should be heard here best, we imagine.

JAPAN.—Two more new Japanese stations are said to be operating at various times, being JLU3 on 15.135 kc and JVW4 on 17,820 kc, while on 7325 kc a station is relaying the Manchukuo broadcast band station JFAK from midnight to 1.30 a.m.

DOMINICAN REPUBLIC.—We hear from a correspondent of ours in Cuba that the Dominican station HI4X in Ciudad Trujillo is now rebroadcasting the N.B.C. programmes on a frequency of 17.410 kc.

HOLLAND.—We heard the Philips Radio station PCJ2 on 19.71 m announce that on and from Tuesday, July 18, they would probably open up an hour earlier (4.0 p.m. E.A.S.T.) in their special Australian and N.Z. broadcast.

READERS' REPORTS

Mr. M. Foster (Mount Vincent, N.S.W.) is a new contributor to our pages, and sends us a very interesting letter of his reception. As you will see from article, your Manila station is KZRM, or occasionally KZEG. Glad you find these pages so helpful, and thanks for kind remarks, and write again.

Mrs. Olsen (Ayr, Qld.).—Many thanks for your letter, which we have replied to by mail.

"K.Mc" (North Fitzroy, Vic.).—Our Melbourne contributor again sends some interesting news concerning his verifications from W8XAL and W6XBE. We have used this information, as you will see, and many thanks for same. Pleased to see you got verification from PK6XX, as they are hard to get all right.

Mr. R. K. Clack (Chester Hill, N.S.W.)—We have replied to your letter by mail. Thank you for remarks re the short-wave section.

Mr. E. Gregory (Manjimup, West Australia) sends us a query re Daventry and Berlin stations, which he is hearing on approximately 21.15 m and 21.05 m. We feel sure that either you are receiving these stations at a repeat point on your dial, or else the dial has slipped, as neither Daventry nor Berlin transmit on these wavelengths. You would be well advised to have a radio serviceman check your set with a signal generator to make sure the dial is reading correctly. Glad you like the paper, but hate to think of the work involved to publish it weekly!

Mr. A. Lee (Dubbo, N.S.W.) again sends us a comprehensive report, which has been incorporated in the "Listen for These" section. We will explain the graph system to you in a letter at the earliest oppportunity, also answer the other points in your letter. Mr. Lee advises that he finds the 49-metre band very much better at night now and not so noisy.

Mr. L. J. Keast (Randwick, N.S.W.), one of our regular readers, comments on the strength of signals from the Orientals, and also mentions a weak station he is hearing late at night on 19.83 m, which he suggests may be the Japanese, JLU3. A peculiarity mentioned by Mr. Keast was the total lack of signals on the night of July 7 between 10.0 and 11.30, when the 16 and 19 metre bands were dead, and also he could not hear W6XBE. At our location conditions were only fair, but not so bad as at Randwick.

Mr. J. Butler (Bellevue Hill, N.S.W.), who is one of the most enthusiastic listeners to the short-wave bands, sends along a list which many readers would very much like to duplicate. Amongst other things, Mr. Butler mentions the prevalence of Morse signals on the various bands which spoil reception on many occasions. Hope the new receiver lives up to its reputation in pulling in the DX stations.

Dr. K. B. Gaden (Thargomindah, Q.) remarks on the excellence of W6XBE in their new afternoon session, and also sends a very helpful list of stations which he has been hearing in his district. The doctor still finds the U.H.F. bands interesting, and appears to be having better receiving conditions than we are in N.S.W. Have written you re the other matter mentioned in your last letter.

Mr. B. W. Battis (Coraki, N.S.W.)—Another new contributor, who sends along his reception report for his loggings of the last few weeks. Mr. Battis only uses a simple detector and one audio, but obtains very good reception from all the main stations. Pleased to hear from you again next month, if possible.

Mr. P. G. Emery (Bathurst, N.S.W.)—We have replied to your letter by mail, answering the criticism you raised. You will be pleased to see we have included both frequency and wavelength in this month's notes. Write again, Mr. Emery, and give us your further views of this section.

RADIO MANILA NOW ON 49 METRE BAND

NEW STATIONS IN FRANCE, U.S.A. AND PARAGUAY

Once again many new stations have been heard at our location during the past few weeks. As was the case last month, some are new stations, while others are stations which, to the best of our knowledge, have only recently been reported in this country.

PHILIPPINE ISLANDS.—Just after we went to press last month we heard Radio Manila, KZRM, operating on a new channel, 6140 kc, 48.86 m. They were very strong, but interfered with greatly by morse, though on some nights this is not in evidence.

On some nights they take the programme of KZRM, while on other occasions we have heard them transmitting one of the other Manila stations, KZEG.

U.S.A.—As mentioned in this section last month, W1XAR, in Boston, Mass., was testing on 11,730 kc and 15,130 kc. Since we wrote this item we have heard them in their 25-metre transmission. So far they only seem to be audible on a Monday morning around 7.30, when they were coming in much better than W1XAL on 11,790 kc, 25.45 m.

PARAGUAY.—On this same frequency, 11.730 kc, 25.58 m, we have now heard ZP4. in Villarica, Paraguay. We heard them at quite good strength one day from 10.30 a.m. until 11.15 a.m. All announcements were in Spanish, but at the hour the words, "Villarica, Paraguay," could easily be distinguished. This new station, if it continues to come in at good strength, will enable many listeners to add a very hard country to their log.

COSTA RICA.—Yet another station in this Central American Republic has now become audible. The newcomer is TILS. which uses 6165 kc, 48.66 m, and is located in San Jose. They can easily be found, as they are the first station lower in wavelength from Radio Manila. They open every night, Sunday included, at 10.0 p.m., with the march "Stars and Stripes For Ever," followed by announcement in Spanish, TILS Radio Parati, San Jose, Costa Rica. News is then given until 10.30 p.m. with one note on chimes between each item, and at the half-hour five notes are given when the call and location are again repeated.

BRAZIL.—Another easily found station which we have recently heard for the first time is PRA8, in Pernambuco. They are on 6015 kc, 49.88 m, just above the German, DJC, and open every morning at 7.0 with clock chiming in the studio. Their first musical number is "Ave Maria," which is usually sung by a lady. This station is operated by the Pernambuco Radio Club, and sends out a very attractive verification card which we hope to receive shortly.

URUGUAY.—Another station which we advised listeners to watch out for is CXA2, in Montevideo, which is now on 9570 kc, 31.35 m. We have heard them on two or three occasions from June 17 onwards, and on the first-mentioned date we heard them at great strength as early as 10.30 a.m. They announce as "Radio Continental CXA2, Montevideo." They were previously on the 49-metre band, where we heard them once, as mentioned in previous issue, but they are now heard very much better on this new frequency.

FRANCE.—One of the strongest stations we have ever heard was one of the new French Government stations on 11,840 kc, 25.34 m, which has been carrying out tests in the late afternoon, when they have been transmitting the programmes from Radio Mondial, and also from some of the other Paris broadcast band stations. As is usual with French stations, it will probably be some time before we actually know its call letters.

JAVA.—We have just heard a station which we do not remember seeing previously reported, though it may have been a few seasons ago. We refer to YDB Soerabaja, 15,310 kc, 19.6 m, carrying the same programme as the well-known YDC on 15.160 kc, 19.8 m. So far we have only heard it in the session which closes at 5.0 p.m., and then at only very weak strength.

Listen for these!

OVERSEAS STATIONS NOW AUDIBLE

Here is a list of short wave stations which have actually been heard over the last few weeks. Most of these should be heard by any of our short wave fans who have a good set and location. Details of each station are given, and when also reported by readers, their names appear in brackets.

ENGLAND

GSA.—6050 kc, 49.59 m, Daventry. Still being heard in the early morning with their transmission for Europe.

GSB.—9510 kc, 31.55 m. This one is very good in Transmission 6, closing at 2.30 p.m., and also, of course, in No. 1, opening at 3.0 p.m. (Foster, Lee.)

GSC.—9580 kc, 31.32 m. Used in the morning session till 7.0, and also opening again at 7.20 a.m. Heard weakly in the afternoons till 2.30. (K. Mc., Lee, Keast, Foster.)

GSD.—11,750 kc, 25.53 m. Very loud at 3.30 a.m., and also at a more convenient time of 4.0 p.m., and weakly at 7.20 a.m. (Foster, Lee, Battis, Keast.)

GSF.—15,140 kc, 19.82 m. Comes in at excellent strength when they open at 7.20 a.m. (Lee, Battis.)

GSG.—17,790 kc, 16.86 m. This one is the better of the two Daventry stations on this band. (Lee, Butler.)

GSH.—21,470 kc, 13.97 m. This one very weak at 11.30 p.m. (Butler.)

GSI.—15,260 kc, 19.66 m. One of the strongest afternoon stations on the 19 metre band. (Lee, Keast, Butler.)

GSJ.—21,530 kc, 13.93 m. Only heard weakly at 11.0 p.m. (Butler.)

GSO.—15,180 kc, 19.76 m. Heard very well in the mornings from 7.20. (Butler, Foster, Lee.)

GSP.—15,310 kc, 19.6 m. Another one heard well on closing at 7.0 a.m., and also opening again at 7.20 a.m. (Keast, Lee, Butler.)

GSV.—17,810 kc, 16.85 m. Only fair now around 11.0 p.m. (Butler, Lee, Foster.)

GRX.—9690 kc, 30.96 m. Heard in the early morning with their foreign session, in chain with GSA. (Keast.)

GERMANY

DJA.—9560 kc, 31.33 m. Very strong at 2.0 p.m., and now also heard quite well before 8.0 a.m. (K.Mc., Foster, Lee, Keast.)

DJB.—15,200 kc, 19.74 m. This one is quite strong in the forenoons, and also in the late afternoon till 5.0. (Butler, Foster, Lee, Battis.)

DJC.—6020 kc, 49.83 m. On the air every morning until 7.30 a.m., but not as strong as before; also loud at 4.0 a.m. (K.Mc., Lee.)

DJD.—11,770 kc, 25.49 m. Loudest at our location at 3.0 a.m., but also heard until closing at 2.0 p.m. (Gaden, Lee, Foster.)

DJE.—17,760 kc, 16.89 m. One of the best daylight stations and heard well until noon. (Butler, Gaden, Foster, Lee.)

DJH.—17,845 kc, 16.82 m. Still heard late at night by Mr. Butler.

DJL.—15,110 kc, 19.85 m. Comes in fairly well around 3.0 p.m., but not as strong as previously. (Butler.)

DJN.—9540 kc, 31.45 m. Very good in the mornings at 7.0 and also in the afternoons until 2.0. (Foster, Lee, Keast.)

DJP.—11,855 kc, 25.32 m. Have heard this one at 7.0 a.m., and also in afternoons until 2.0. (Butler, Gaden, Lee.)

DJQ.—15,280 kc, 19.63 m. Heard best in the forenoons at about 11.30. (Battis, Butler, Foster, Lee.)

The names given after many of the calls listed here refer to regular listeners who have sent in reports. We invite any of our Short Wave enthusiasts to send in similar reports. If you have any queries on short wave matters, write to Ray Simpson, c/o Radio and Hobbies, Box 3366 JJ, G.P.O., Sydney.

DJR.—15,340 kc, 19.56 m. This is the loudest German in the forenoons. (Butler, Battis, Lee, Foster.)

DJS.—21,450 kc, 13.99 m. Mr. Butler heard this one weakly at 11.30 p.m.

DJX.—9675 kc, 31.01 m. Quite a good signal from this one in the mornings till 7.30. (K.Mc., Foster, Lee, Keast.)

DJZ.—11,801 kc, 25.42 m. Another 25 metre band station heard in the afternoon until 2.0 p.m., when DJP is not in use. (Foster.)

DZC.—10,290 kc, 29.15 m. One morning at 4.0 this one was coming in at a terrific level.

DZG.—15,360 kc, 19.54 m. Sometimes heard at 9.0 a.m. (Butler.)

DZH.—14,460 kc, 20.75 m. Special transmission to Buenos Aires at 9.0 a.m. (Lee.)

FRANCE

TPB?.—11,845 kc, 25.33 m., Paris. This is the new French station which has been testing on some days around 4.0 p.m.

TPB3.—17,350 kc, 16.81 m., Paris. Only heard at very weak strength on the 16 metre band late at night. (Butler.)

TPB6.—15,130 kc, 19.83 m., Paris. Only fair at 4.30 p.m. Note the call letter previously given as TPB11. (Lee, Butler.)

TPB7.—11,885 kc, 25.23 m., Paris. Very good in the early afternoon and also around 4.0 p.m. (Foster.)

TPB11.—7280 kc, 41.21 m., Paris. This is the French station on the 41 metre band; very good every morning until closing at 8.15. (Lee.)

TPA2.—15,245 kc, 19.68 m., Paris. Heard on some nights very weakly at 11.0 o'clock. (Butler.)

TPA3.—11,88? kc, 25.23 m., Paris. This one is heard very well in the early morning at 7.0 o'clock.

TPA4.—11,720 kc, 25.6 m., Paris. Comes in very nicely every day until 2.0 p.m. (Foster, Lee.)

POLAND

SP19.—15,120 kc, 19.84 m. Warsaw. Can still be heard in the mornings, when they open at 9.0.

SP25.—11,740 kc, 25.55 m, same location. Used jointly with SP19, but not heard very well.

SP31.—9520 kc, 31.51 m, same location. Opens in the mornings at 6.0, but can only just be separated from RV96 (Keast.)

SP48.—6140 kc, 48.86 m, same location. This one is used at the same time as SP31, with quite good signal.

AFRICA

CR7AA.—6137 kc, 48.88 m, Lourenco Marques, Mozambique. This is one of the best stations on the 49 metre band in the early morning.

VQ7LO.—6083 kc, 49.32 m, Nairobi, Kenya. Can be heard at very good strength at 5.0 a.m. (Keast.)

ZRH.—6007 kc, 49.94 m, Roberts Heights, South Africa. Not as strong as a few weeks ago, and heard best on Sunday morning. (Foster.)

Radio Tananarive.—6063 kc, 49.48 m, Tananarive, Madagascar. Opens up with the Marseillaise at 1.0 a.m., but quality is very poor.

Radio Tananarive.—9693 kc, 30.95 m, same location. Heard at the same time as the other Tananarive station, and much better quality. (Butler.)

IABA.—9650 kc, 31.09 m, Addis Ababa, Ethiopia. This one is heard best just before they close down at 6.0 a.m. with Italian National Anthem.

EAJ43.—10,370 kc, 28.92 m, Teneriffe, Canary Islands. Can be heard most mornings. Now seems to open at 7.30. (Butler.)

EA9AH.—13.997 kc, 21.43 m, Tetuan, Spanish Morocco. Heard occasionally until 9.0 a.m. (Butler.)

NORTH AMERICA

W1XK.—9570 kc, 31.35 m, Boston, Mass. Heard weakly at 3.0 p.m. and also occasionally at night. (Gaden, Foster.)

W1XAL.—11,790 kc, 25.45 m, same location. Can be heard in the early mornings around 7.0 a.m., not very strong. (Gaden, Lee.)

W1XAR.—11,730 kc, 25.28 m, same location. New station, see article.

W1XAL.—15,250 kc, 19.67 m, same location. Mr. Butler heard this one closing weakly at 1.0 p.m.

W2XAD.—9550 kc, 31.41 m, Schenectady, N.Y. This infrequently heard station comes in some mornings at 8.30 a.m. (Gaden.)

W2XAF.—9530 kc, 31.48 m, same location. Can be heard in the afternoons around 2.0 p.m., but not very strong. (Lee, Gaden.)

W2XE.—17.830 kc, 16.83 m, New York, N.Y. Heard at good strength on opening at 9.30 p.m. (Butler.)

W2XAD.—15,330 kc, 19.57 m, Schenectady, N.Y. Heard occasionally late at night. (Butler.)

W3XL.—17,780 kc, 16.87 m. New York, N.Y. At noon this station is quite good strength. (Butler, Gaden.)

W3XAL.—9670 kc, 31.03 m, same location. Can still be heard at 3.0 p.m. and also in the mornings from 8.0 a.m.

W4XB.—6040 kc, 49.67 m, Miami, Flo. Heard best on Sunday afternoon until closing at 4.0 p.m. with English and Spanish.

W6XBE.—15,330 kc, 19.57 m, Treasure Island, Cal. Heard at lunch-time at fair strength, sports talk at 1.50 p.m. (Gaden, Butler.)

W6XBE.—9530 kc, 31.48 m, Treasure Island, Cal. No introduction needed as heard at excellent strength from 10.0 p.m. and also in their new session from 3.0 p.m. till 6.0 p.m. Listeners' letters answered over the air; news at 10.30 p.m. (Gaden, Butler, Battis, Lee, Keast, Gregory, Foster.)

W8XK.—11,870 kc, 25.27 m, Pittsburg, Pa. Heard best in the forenoon at about 10.0 a.m. (Foster.)

W8XK.—15,210 kc, 19.72 m, Pittsburg, Pa. Only heard weakly at midnight by Mr. Butler.

W8XAL.—6060 kc, 49.5 m, Cincinnati, Ohio. Still puts in a nice signal in the afternoon towards 4.0 p.m., not heard nearly as well at nights now. (Foster, Lee, Gaden.)

XEWW.—9500 kc, 31.5 8m, Mexico City, Mexico. This is the best heard Mexican, and comes in at night after 11.0 p.m. and also on Sunday afternoons till 4.0 p.m. (Gaden.)

XEFT.—9550 kc, 31.41 m, Veracruz, Mexico. This one can now just be heard on Sundays till closing at 2.30 p.m.

XEDQ.—9526 kc, 31.5 m, Guadalajara, Mexico. Another Mexican who can also be heard on Sundays till closing at 3.0 p.m. Very weak, but should soon improve.

XEXA.—6175 kc, 48.58 m, Mexico City, Mexico. Only heard at the beginning of July, and is now inaudible at our location.

NEW STATIONS

EACH month in this panel we will list all stations, definitely identified, which have not been previously heard, either at our own location or by our readers.

KC	Metres	Call	Location
6,015	49.87	PRA8	Rio de Janeiro, Brazil.
6,110	49.1	KZRH	Manila, Philippine Is.
6,140	48.86	KZRM	Manila, Philippine Is.
6,165	48.66	TILS	San Jose, Costa Rica.
7,260	41.30	CSW8	Lisbon, Portugal.
9,570	31.35	CXA2	Montevideo, Uruguay.
11,730	25.58	WIXAR	Boston, Mass., U.S.A.
11,730	25.58	ZP14	Villarica, Paraguay.
11,845	25.33	—?	Paris, France.
15,310	19.6	YDB	Soerabaja, Java.

INDIA AND ASIA

VUD2.—9590 kc, 31.28 m., Delhi, India. Opens up at 10.30 p.m. with clock chimes and by 11.0 p.m. is quite strong. (Keast, Lee.)

VUD2.—4960 kc, 60.48 m., same location. Heard with the same programme, but not as strong.

VUD3.—15,290 kc, 19.62 m., same location. Comes in best around lunch time, but also heard until closing at 6.30 p.m.(Butler.)

VUM2.—4920 kc, 60.98 m., Madras, India. This station is very weak on opening at 9.0 p.m., though heard at good strength one morning at 2.0.

VUC2.—4840 kc, 61.98 m., Calcutta, India. Heard quite strongly late at night by Mr. Lee.

KZIB.—9500 kc, 31.58 m., Manila, Philippine Islands. One of the regular 31 metre band stations. We understand that a second transmitter will be in use shortly. (Foster, Battis, Lee.)

KZRM.—9570 kc, 31.35 m., same location. Heard well every night and also on opening at 7.30 a.m. (Foster, Lee, Keast, Battis.)

KZRM.—6140 kc, 48.86 m., same location. As mentioned elsewhere this station is now using this frequency, and also rebroadcasting KZEG. (Foster, Keast, K.Mc., Gaden.)

KAY.—14,980 kc, 20.03 m., same location. Heard in special broadcast one night at 9.0 at very good strength.

JLG.—7285 kc, 41.2 m., Tokio, Japan. At 1.30 a.m. this station is very loud, in local type programme. (Clack.)

JLG3.—11,705 kc, 25.63 m., same location. On the air every morning until 7.0, and occasionally until 8.30. (Foster.)

JLT.—6190 kc, 48.47 m., same location. Very strong some nights after 11.0, but not on regularly.

JLT2.—9645 kc, 31.11 m., same location. This Japanese was heard at fair strength by Mr. Foster.

JVW3.—11,720 kc, 25.6 m., same location. Comes in best at 10.30 p.m., but not very interesting. (Foster, Keast, Lee.)

JIE.—7290 kc, 41.08 m., same location. This is a new station mentioned by Mr. Butler, closing weakly at 1.15 a.m.

JZJ.—11,800 kc, 25.42 m., same location. Heard best at 7.0 a.m., but also at other times.

JZK.—15,160 kc, 19.79 m., same location. Puts in a very strong signal at night between 10.0 and 10.30; also heard opening at 3.30 p.m. (Foster, Butler.)

JDY.—9925 kc, 30.23 m., Darien, Manchukuo. Very strong every night. News in English at 10.45. (Lee.)

MTCY.—6125 kc, 48.98 m., Hsinking, Manchukuo. Can now be heard on some nights before 11.30, but usually opens at that time. (Keast, Butler.)

JFO.—9635 kc, 31.13 m., Taihoku, Taiwan. On the air every night and now seems to close earlier.

JIB.—10.535 kc, 28.48 m., same location. This one also now seems to close down at midnight.

9690 kc, 30.96 m., same location. This is a new station heard at midnight, rebroadcasting same programme as JIB.

YDA.—6045 kc, 49.63m, Tanjong Priok, D.E.I. One of the best stations on the 49 metre band late at night. (Battis.)

YDB.—9550 kc, 31.41 m., Bandoeng, Java. Not very strong, but audible on 31 metre band every night.

YDC.—15,150 kc, 19.81 m., same location. At night this is one of the few stations still audible on 19 metre band, also heard at 9.0 a.m.; also opens fair at 1.30 p.m. (Butler, Foster, Keast, Lee.)

YDX.—7220 kc, 41.55 m., Medan, Sumatra. Strong every night; relays N.I.R.O.M. programme late at night. (Clack, Lee.)

PMH.—6720 kc, 44.64 m., Bandoeng, Java. This powerful station is always heard at night and gives some interesting numbers by native orchestra. (Foster, Lee.)

PMN.—10,260 kc, 29.24 m., same location. This one is very weak now and not at entertainment strength. (Foster, Lee.)

PLP.—11,000 kc, 27.27 m., same location. Can still be heard at night, but not as strong as previously. (Lee, Foster.)

PMY.—5140 kc, 58.31 m., same location. This higher wavelength station gives some interesting programmes nightly from 8.30 p.m. (Lee.)

HS6PJ.—19,920 kc, 15.77 m., Bangkok, Siam. Comes in weakly at 11.0 p.m. on some nights. (Butler.)

HS6PJ.—9510 kc, 31.55 m., same location. Now on the air four nights weekly; good level, frequent English announcements. (Keast.)

Philco Radio.—11,710 kc, 25.62 m., Saigon, F.I.C. Heard very well at 11.30 p.m. by Mr. Keast.

Radio Saigon.—6116 kc, 49.05 m., same location. This station excels on the 49 metre band every night. (Lee, Foster.)

Radio Saigon.—11,780 kc, 25.47 m., same location. Same station, heard at very good strength at 11.30 p.m. English announcements.

XYZ.—6007 kc, 49.94 m., Rangoon, Burma. At 11.0 p.m. this one is quite strong on most nights.

ZHP.—9690 kc, 30.96 m., Singapore, S.S. By closing time, 12.40 a.m., this Malayan is very good. Rebroadcasts Daventry every night with their news session. (Foster, Keast, Lee.)

ZHJ.—6090 kc, 49.25 m., Penang, S.S. Evidently has new transmitter, now heard at excellent strength nightly. (Mr. Keast reports them again on 49.51 m.). (Gaden, Foster, Lee, Battis, Keast.)

XTC.—9295 kc, 32.28 m., Shanghai, China. Opens every night at 11.0 o'clock, but not very loud. Call previously given as XGX. (Keast.)

XMHA.—11,850 kc, 25.32m, same location. Another station not heard as well as previously, but still audible nightly. (Keast, Foster.)

XGOK.—11,820 kc, 25.37 m., Canton, China. Wandering in frequency, and never the same as that announced.

XPSA.—7000 kc, 42.8 m., Kweiyang, China. Another very loud Chinese on the air nightly till after midnight. (Butler, Foster, Lee.)

XGOX.—17,800 kc, 16.85 m., Chungking, China. Heard on some days with weak signal around noon. (Butler, Keast.)

XGOY.—11,900 kc, 25.21 m., same station and location. Heard both at night and in the early mornings; English news session at 9.20 p.m. Deviates from announced frequency. (Battis, Lee, Keast, Foster.)

ZBW3.—9525 kc, 31.5 m., Hongkong, China. Very much louder than a few weeks ago, but interfered with after 10.0 p.m. by W6XBE. (Butler, Lee, Foster, Keast, Battis.)

ZBW5.—17,775 kc, 16.87 m., same location. Reported by Mr. Butler heard at 10.0 p.m. in same programme as ZBW3.

ITALY

IRF.—9830 kc, 30.52 m. At 3.0 a.m. this Italian station was putting in a very loud signal.

IRJ.—13,220 kc, 22.7 m. This transmitter was heard with a special transmission for Germany on Sunday at 11.0 a.m. (Butler.)

IQY.—11,675 kc, 25.74 m. Very loud in the early hours of the morning, also occasionally in forenoon. (Gaden.)

2RO3.—9635 kc, 31.13 m. Still one of the best in the mornings on 31 metre band. Reads letters from listeners, with many interesting comments. (K. Mc., Gaden, Lee.)

2RO4.—11,810 kc, 25.4 m. Heard best at 3.0 a.m., but also audible at more convenient time of 7.0 a.m. (Gaden.)

2RO6.—15,300 kc, 19.61 m. On some mornings this Italian puts in a very good signal at 8.0 Also heard in forenoon. (Butler, Gaden, Lee.)

2RO8.—17,820 kc, 16.84 m. A very interesting session is heard from this one from 10.30 a.m. onwards. (Gaden. Butler. Lee.)

2RO9.—9667 kc, 31.03 m. Another 31 metre band station which very often carries the same programme as 2RO3 but not at such great strength. (Lee, Gaden, K. Mc., Foster.)

2RO12.—15,100 kc, 19.87 m. Very weak, but can just be identified at 7.0 a.m. by comparing with other Italian stations.

SWEDEN

SBT.—15,155 kc, 19.79 m, Motala, Sweden. Very weak now in early morning session, closing at 7.15, but heard much better in their new transmission, opening at 11.0 a.m. Sundays. (Butler.)

SBP.—11,705 kc, 25.63 m, same location Quite loud in the early morning programme, closing at 7.15, but not heard so well in the new session opening at 11.0 a.m. Sundays. (Gaden.)

SBU.—9535 kc, 31.46 m, same location. Opens at 7.15 a.m., but very hard to separate from other stations in vicinity. (Butler, K. Mc.)

SBO.—6060 kc, 49.5 m, same location Also opens at 7.15 a.m., and is quite good at that time.

SOUTH AMERICA

CXA2.—9570 kc, 31.35 m, Montevideo Uruguay. New station mentioned in other article.

CXA6.—9620 kc, 31.19 m, same location Still heard in the mornings, opening at 6.30, and being best at 7.0. (Butler.)

CXA8.—9640 kc, 31.12 m, same location Can be heard at night at 10.30, and also on Sunday afternoons until 4.0 and also in mornings at 8.0. (Gaden.)

OAX4J.—9340 kc, 32.12 m, Lima, Peru One of the best South Americans on Sunday afternoons. Title is Radio National del Peru. (Butler, Foster.)

OAX4T.—9566 kc, 31.38 m, same location. Opens at 11.0 p.m. with a march and is very strong. Announces as OAX4A and OAX4T. (Butler.)

OAX5C.—9350 kc, 31.95 m, Ica, Peru Another Sunday afternoon regular with closing announcement in English. (Butler.)

LRA1.—9690 kc, 30.96 m, Buenos Aires, Argentine. Heard in the early afternoon, and also in the mornings, opening at 8.0—7.0 on Saturdays. (Butler.)

LRX.—9660 kc, 31.06 m, same location Heard at quite good strength in the mornings at 8.0, and also at 10.0 p.m. on Sundays. (Butler, Gaden, Keast.)

LRU.—15,290 kc. 19.62 m. same location. Mr. Butler heard this one very weakly one afternoon at 2.0.

PSE.—14.940 kc, 20.07 m. Rio de Janeiro, Brazil. Very good signal until 7.30 a.m., with special programme to Germany.

PRA8.—6015 kc. 49.87 m, Pernambuco, Brazil. This is the new station heard in the mornings mentioned elsewhere.

CB960.—9600 kc, 31.25 m, Santiago, Chile. Can still be heard with their morning exercises from 10.0 p.m. onwards E.A.S.T.

CB970.—30.91 m. Valparaiso, Chile Heard on one day only, with weak signal, at 2.0 p.m. (Foster.)

CB1180.—11.970 kc, 25.06 m, Santiago, Chile. On most nights this one can be heard between 10.30 and 11.0. (Gaden.)

CD1190.—11,910 kc, 25.19 m, Valdivia, Chile. Now being heard quite well in the mornings from 8.0 till about 9.30.

HCJB.—12,460 kc, 24.08 m, Quito, Ecuador. Can still be heard between 10.0 p.m. and 11.0 p.m., and also occasionally in the late afternoons. (Foster.)

ZP14.—11,730 kc, 25.58 m, Villarica, Paraguay. This is the new station now heard well in the forenoons around 11.0.

CENTRAL AMERICA AND WEST INDIES

COCQ.—Havana, Cuba. This station is jumping around between about 8850 kc and 8980 kc, and is not so loud now as it was a few weeks ago. (Lee, Foster.)

COBC.—9985 kc, 30.05 m., same location. This is one of the best Cubans, heard nightly from 10.0 o'clock and sometimes as early as 9.30. (Keast.)

COJK.—8685 kc, 34.54 m., Camaguey, Cuba. This station is heard very well now nightly from 9.55 o'clock. Their first number is "Tippy, Tippy,

MYSTERY STATIONS

THIS month we have quite a few strange stations to list so we will not waste space with any preamble.

15,220 kc, 19.71 m. European, heard weakly till 1.0 p.m.

15,230 kc, 19.70 m. Very strong station, heard on two occasions for over two hours without announcement till 4.0 p.m.

15,130 kc, 19.83 m. Oriental, heard between 11.0 p.m. and 2.30 a.m.

9,600 kc, 31.25 m. Very weak station, with lady announcer, closes at 7.30 a.m. with short piano number.

Three other stations all carrying the same programme are heard every morning on the 31 metre band between 7.0 a.m. and 7.30 a.m. Lady announcer usually, quality very poor, sounds like Spanish.

7.050 kc, 42.5 m. French station, which is heard weakly every night. Closes at midnight with Marseillaise.

11,775 kc, 25.48 m. Heard at 5.30 p.m. very weakly. (Gaden).

11,825 kc, 25.37 m. Another station with same programme, also heard at night about 9.30 p.m. (Gaden).

11,730 kc, 25.58 m. Heard in early mornings. (K.Mc.) (probably ZP14).

A few other stations have been mentioned by readers, but frequency or wave-length not always accurate enough for inclusion in this section, so will leave until next month, by which time we may have further news of them.

Tin," and they announce as COCO and CMCK Radio Philips. (They actually rebroadcast these two latter stations and do not give their own call letters.

COBZ.—9028 kc, 33.24 m., Havana, Cuba. Only heard occasionally and then very weakly at 11.0 p.m.

COCH.—9437 kc, 31.79 m., same location. Opens nightly at 10.0 o'clock and can also be heard in the afternoon. (Gaden.)

COGF.—11,800 kc, 25.42 m., Matanzas, Cuba. Now heard from 9.0 p.m., and has now moved slightly, evidently to escape interference from JZJ, which is on at same time.

COCM.—9850 kc, 30.46 m., Havana, Cuba. On some nights this station is heard at good level from 11.0 o'clock onwards.

TIPG.—9620 kc, 31.19 m., San Jose, Costa Rica. Now one of the best stations on the 31 metre band at night opening at 10.0 o'clock, but fades out by 11.0. (Gaden.)

TILS.—6165 kc, 48.66 m., same location. This is the new station mentioned elsewhere.

TI2XD.—11,940 kc, 25.13 m., same location. Heard on a few mornings at 7.0 o'clock with quite a good signal.

HP5J.—9590 kc, 31.28 m., Panama City, Panama. Opens every night at 10.0, but not as strong as formerly. (Gaden.)

HP5A.—11,700 kc, 25.64 m., same location. Heard every night from 10.0 with quite a good signal.

TGWA.—9685 kc, 30.98 m., Guatemala City, Guatemala. Heard on Sunday afternoons with good signal, special DX programme on August 20, from 4.0 p.m. till 6.30 p.m. (Gaden, Lee, Butler, Battis, Foster.)

TGWB.—6490 kc, 46.2 m., same location. Also heard on Sunday afternoons and occasionally at night after 10.30. (Gaden, Foster.)

TG2.—6190 kc, 48.47 m., same location. Heard in the late afternoon on Sunday with strong signal. Usually dif-TGWB. (Gaden).

HI1N.—6243 kc, 48.05 m., Trujillo Ciudad, Dominican Republic. Heard by Dr. Gaden until closing at 6.15 p.m. one Sunday.

Radio Martinique.—9705 kc, 30.92 m., Fort-de-France, Martinique. Can be heard in the mornings at 8.30.

U.S.S.R.

RAL.—9600 kc, 31.25 m. Moscow. This one heard opening some mornings at 7.0 with French session. Notice new call.

RNE.—12.000 kc, 25.0 m. One of the oldest of the Russian stations, and heard at good strength at various times. (Keast, Lee, Mrs. Olsen, Foster.)

RKI.—15,080 kc, 19.89 m. Used in the forenoon sessions.

RV96.—6040 kc. At 2.0 a.m. this station was heard at terrific level. (K. Mc., Foster.)

RV96.—9520 kc, 31.51 m. In the mornings this station is one of the loudest on the 31 metre band. (Foster, Lee, Keast, K. Mc.)

RV96.—11,900 kc, 25.21 m. Another Russian which is heard till 9.30 a.m. with Spanish session.

STOP PRESS!

KZRH — THE VOICE OF THE PHILIPPINES ON THE AIR

Another new Manila station which we heard for the first time on July 13 is KZRH—"The Voice of the Philippines," which was conducting a test programme on 6,110 kc, 49.1 m, though in their announcements they only mentioned 1200 kc, 250 m, which would be their broadcast band outlet. Dance music was heard from before 10 p.m. till after 11 p.m. They are located on the seventh floor of some building in down-town Manila. Strength was good, though interfered with slightly by Radio Saigon.

PRAGUE HEARD AGAIN

Just as we go to press we have identified the station on 15,230 kc, 19.7 m, which we had been hearing until closing at 1 p.m. It is the once well-heard OLR5A in Prague, and the closing announcement was clearly heard on Sunday, July 16, when they closed at the usual time of 1 p.m. Prior to that they had played marching tunes for half an hour without announcement. It will be interesting to watch for the Prague stations on the other bands where they formerly were heard at good strength.

RV96.—15,180 kc, 19.76 m. Heard at excellent strength in the forenoon around 10.0 o'clock, also in afternoon. (Butler, Foster, Lee.)

RV96.—15,230 kc, 19.7 m. This one closes at 6.45 a.m. with Spanish programme.

RV96.—15,400 kc, 19.49 m. Heard at different times, but best in the mornings.

MISCELLANEOUS

OFD.—9500 kc, 31.58 m., Lahti, Finland. Still very weak in the mornings, but can just be identified.

OIE.—15,190 kc, 19.75 m., same location. Not as strong as last month, but still audible until Daventry overwhelms it. (Butler.)

OIH.—17,800 kc, 16.85 m., same location. Mr. Butler heard this one in a test transmission at 7.30 p.m.

OZF.—9520 kc, 31.51 m., Skamlebaek, Denmark. This 31 metre Danish station can be heard closing at 2.0 p.m. Sundays.

OZH.—15,165 kc, 19.8 m., same location. Heard on two occasions by Mr. Butler.

OZH2.—15,320 kc, 19.58 m., same location. Also heard at good strength on several occasions at 11.30 p.m. (Butler.)

ORK.—10,330 kc, 29.04 m., Ruysselede, Belgium. Comes in at good strength in early morning till about 6.0. (Foster.)

CS2WD.—5977 kc, 50.2 m., Lisbon, Portugal. Still heard every morning from 7.0 onwards.

CSW7.—9735 kc, 30.81 m., same location. Heard quite well till closing with chimes of midnight at 9.0 E.A.S.T.

CSW8.—7260 kc, 41.3 m., same location. Now one of the best morning stations and closes down at 8.0. English announcements heard on Sunday mornings. (Lee, Butler.)

Radio Malaga.—14.440 kc, 20.78 m., Malaga, Spain. Heard in the mornings from 8.30 onwards.

EAQ.—9860 kc, 30.44 m., Madrid, Spain. This once popular station can again be heard every morning at 7.0 (Foster, Lee.)

YUA.—6100 kc, 49.18 m., Belgrade, Yugoslavia. A 49 metre station heard every morning at 7.0. (Butler.)

LKQ.—11,740 kc, 25.55 m., Oslo, Norway. This one has now been heard as late as 7.30 a.m., but very weak.

LLG.—9610 kc, 31.22 m., same location Heard a few weeks ago at 7.0 a.m. but now appears to be discontinued (Butler.)

LKJ.—6130 kc, 48.94 m., same location Fair signal at 7.0 a.m.

LKV.—15,170 kc, 19.78 m., same location. Has now been heard in the early morning with same programme as LLG, and also heard by Mr. Butler at 10.45 p.m.

PCJ.—9590 kc, 31.28 m., Huizen, Holland. On Wednesday mornings comes in very well until 6.30. (Gaden.)

PCJ2.—15,220 kc, 19.71 m., Hilversum, Holland. Comes in best on Tuesday afternoon session, and also weakly at night. (Butler.)

PHI2.—17,770 kc, 16.88 m., same location. Only heard weakly now at night. (Butler.)

HVJ.—6190 kc, 48.47 m., Vatican City. Heard until closing at 6.30 a.m. Sunday.

HVJ.—17,850 kc, 16.81 m., same location. Came in nicely one morning at 3.0. (Butler.)

HBH.—18,480 kc, 16.23 m., Geneva, Switzerland. Heard weakly one morning at 2.0 by Mr. Butler.

HBJ.—14,535 kc, 20.64 m., same location. Comes in at very good strength on their programme days at 3.45 p.m. (Lee.)

HBO.—11,402 kc, 26.32 m., same location. Another Swiss station heard at the same time at good strength. (Lee.)

TAP.—9465 kc, 31.7 m., Ankara, Turkey. Still being heard with an excellent signal every morning. Have heard that verification cards will shortly be sent out. (Lee, Keast, K.Mc., Foster, Butler.)

ZAA.—6085 kc, 49.3 m., Tirana, Albania. This Albanian station has again been heard on several mornings. Usually closes around 7.15 a.m. with Italian National Anthem.

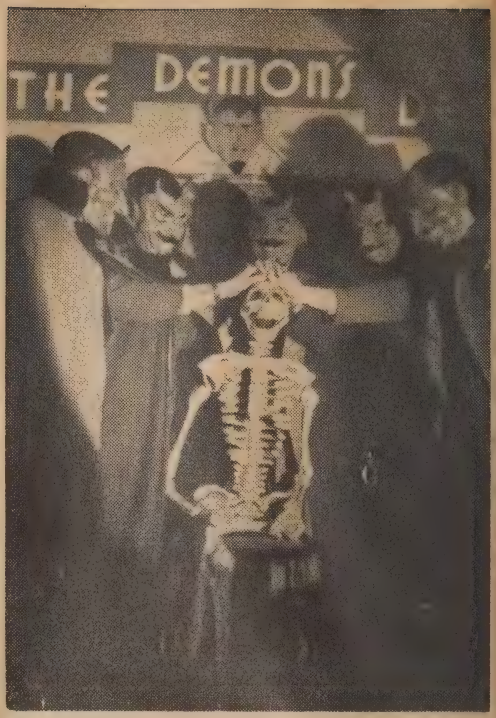
Radio Eireann.—9595 kc, 31.27 m., Moydrum, Eire. Still being heard every second morning, opening at 7.30 with lady announcer, followed by a news session. Call and frequency given twice. (K.Mc.)

Radio Eireann.—17,840 kc, 16.82 m., same location. Mr. Butler heard this station infrequently at 7.0 a.m. with fair signal.

LYR.—9280 kc, 32.33 m., Kaunas, Lithuania. Only heard infrequently at 11.0 p.m. and later, but now very weak.

VPD2.—9538 kc, 31.46 m., Suva, Fiji. Still being heard every night until 10.0 p.m., with quite a good signal. (Battis, Foster, Lee, Butler.)

Demons on entering their den are admitted by the Chief Demon, who demands a hand-shake, which is known only to themselves. Only Demons may enter. Demons are known to each other by numbers only.



Before tricks and illustrations are practised or discussed at each meeting, "The Five Demons" together solemnly promise not to disclose or expose the magical secrets of their hobby or profession.

WHO ARE THE FIVE DEMONS?

Mystery Band Of Magicians

Who are "The Five Demons": This is the question that has been on the tongues of many in Sydney. During the month I had the unique experience of being the guest of this mysterious band of expert magicians.

"WHO are "The Five Demons"? This is the question that has been on the tongues of many in Sydney. During the month I had the unique experience of being the guest of this mysterious band of expert magicians. Yes, I was actually admitted right into the den of mysteries. They do have a den, all right, with the words, printed in large letters, "The Demons' Den," at the entrance.

MEMBERSHIP OF FIVE

On being admitted to the den, I was silently taken to what appeared to me to be the Chief Demon, and here I was formally requested not to divulge the location of their den—this I readily did. Then I was asked to sit quietly by the side while the Five Demons began to practise many of their tricks and illusions.

Naturally, I was eager to engage one or all of them in conversation, but this was not possible until later in the evening, when practice had finished. Even then the interview took place with the various Demons fully hooded and cloaked. I found out many things. This little band of magicians is restricted to a membership of five only and is said to be the most unique organisation of its kind in the world. They have no president, no secretary, no treasurer. Their motto seems to be, "One for all, and all for one." As members of "The Five Demons," they refuse to divulge their names, but, as business men of Sydney, I have found out that they are well-known professional and amateur magicians—their names still remain a mystery to me.

A common interest in magic both as a hobby and profession brought them

(Continued on page 62)

THROW YOUR VOICE

into a trunk, under the bed—anywhere.

THE VENTRILO

An instrument fits into the mouth; cannot be detected. With the aid of this Double throat of VENTRILO you can imitate birds, animals, etc. Everything for ONE SHILLING, including a FREE booklet giving you full instructions how to become a Ventriloquist and throw your voice.

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by Barry Kent

MAGIC

MYSTERIES OF THE MAGIC EAST

Over and over again, I have been asked questions about many Eastern tricks, and tricks that have made the Orient the home of all that is weird and mystic. Among the many tricks that constantly come to the mind of the average person interested in magic, is "The Indian Rope Trick" and "The Mango Tree Trick."

MANY readers of this journal have written me and asked me about these two elusive mysteries, and so I will give you one or two interesting facts that will help to solve, first of all, "The Indian Rope Trick" and also "The Mango Tree Mystery."

First of all, I think it would be good to say this, Shah Mahomed, who, as far as I can gather, is the oldest Indian magician living to-day, and still performs in India, has NEVER SEEN THE ROPE TRICK—he is over 97 years of age and has toured all over India in search of this elusive mystery.

Other great magicians from England and America have also toured India from the north to the south in search of someone who will show them this trick, and never yet has a magician produced this famous myth of mystery. The Great Nicola now in Australia offered £1000 to anyone who would show him the trick, as it is described by travellers to India.

A MYTH?

In a talk with Nicola himself about this trick, he said: "I came to the conclusion that the rope trick was like chop suey—you hear a lot about it outside China, but you never hear it mentioned there. People expect me to know all about the Indian rope trick, because of my associations with the greatest of Indian magicians, but it doesn't seem any use telling them that there isn't any such trick—that is, as it is described by the traveller to India."

Other great magicians, Carter the Great, Dante, Levante have all offered huge sums to see this trick, but never a person comes forward to claim the money—why? Is it because there is no such trick—or is it because the masters of magic in India do not want this great mystery exploited for stage uses in the western world? Time alone will tell.

OR HYPNOTISM?

Very frequently, great magicians will include what they call an "Indian Rope Trick" in their programmes—Nicola has one, but it is not the rope trick we are in search of. Many people attribute the true secret to hypnotism on the part of the performer, who uses mass hypnotism on his onlookers; again, all I can say is, "Show me the trick, even this way." Frankly, I think magicians generally welcome the stories told about this mystery—it is all good publicity for them and their shows, and it helps to maintain a mystery atmosphere for their magical productions. Nevertheless, the study of this trick is interesting, and no doubt a certain amount of truth must be there in the beginning for the stories to originate. Any readers who have seen the trick in India or elsewhere, please drop me a line telling me of your experience. I would be glad to hear from you.

Another great magician to tour India in search of oriental mysteries and the "Rope Trick," in particular, was Okito. His summing up was this: "The trick has never been done—I have never seen it." He also said that the average Indian magician and fakir do exactly the same eight to twelve tricks, and this is a limit to their repertoire. They do these few tricks really well. They all squat in the middle of the street and work for what they can get. Actually, the wonders and mysteries of India are really below the level of the white magician's magic. All great conjurers including Devante, Thurston, Kellar, Raymond, Carter and Nicola, all agree on this. The native Indian fakir is considered a beggar—a salaried man, and a dignified conjurer is non-existent in India.

(To be continued—Next month, "The Mango Tree Trick")

WHO'S WHO IN MAGIC

NICOLA

THE great Nicola has for over 40 years toured the far corners of the earth in search of new mysteries —and, what is more, he has found them and included them in his present great and spectacular mystery production. From the busiest centres of humanity to the smallest and most remote outposts of civilisation, Nicola has presented his whirlwind array of bewildering magic and brilliant illusions. To the subjects of 50 flags, the name Nicola really means something. To meet the great Nicola one is impressed with his unassuming and unaffected modesty, despite his great knowledge and experience of magic. His recent tour of New Zealand was even a greater success than his previous visit there, where record attendances were broken over and over again at the theatres where Nicola appeared. In India, the home of magic and mystery, Nicola was made a member of the Necromantic Society of India, the most select circle of magicians in the world. Not only is he the only white man ever to be accorded this honor, but Indian magicians proclaim him to be the greatest magician ever to perform in India. Now Nicola is back in Australia on his farewell tour with a larger and more spectacular magic show than ever before, featuring many new and amazing illusions. All those interested in magic as a hobby or profession are recommended to see the great production and witness the mystic feats that really baffled the sorcerers of the Orient. Over two hours of quick-moving mystery after mystery go to make his wonderful entertainment. Properties alone, not counting personal baggage, require 95 trunks, cases and crates to pack. All these mysteries will practically fill a sixty-foot express railway car, and the properties weigh some 50 tons.

Magicians, see Nicola when he appears at your theatre; he will mystify you—he will amaze you, and he will entertain you, and you will learn much about this wonderful hobby, magic.

PUZZLE. Remove the card without dropping the penny. Not as easy as it seems—or does it?

Give the card a "flick" quickly with the finger of the other hand, and the card will go spinning away, to leave the coin balanced perfectly on the other finger. Try it.

A selected card is pushed down into a tapering glass by a spectator. Nothing happens. The Magician removes the card, breathes the magic word, and pushes it down in the glass again—and slowly and mysteriously the card rises. THE SECRET. Rub soap on the opposite sides of the glass—inside when you push the card in, see that it touches the soaped surface, and the card will rise slowly.

WHO ARE THE FIVE DEMONS?

(Continued from Page 60)

together some years ago, and they then formed "The Demons' Den" as a meeting-place. The "Den" on each occasion of their meeting changes location. A different time and place is arranged for each meeting, and meetings are held with more or less frequency, depending on their needs. "The Five Demons" receive new tricks and illusions from the principal overseas magic depots in America, England, and the Continent regularly, and have a magic library of books and magazines totalling more than one thousand volumes. Included in their various arts they practise magic, black-art, ventriloquism, juggling, music, comedy, escapology, and sleight-of-hand. In our next issue, I will pass on to you one or two of the tricks the Demons gave me on my visit to their den.

On many occasions "The Five Demons" have produced their own magical revues for deserving charities in Sydney. At these functions King Magic reigns supreme and baffling mystery is in the air. The most outstanding production attempted by this band was "Hocus Pocus," staged some little time ago for two charities. Since then productions, such as "Abracadabra," "Hey, Presto," and "Foo-Ling-Yu," have been presented, all in the mystery atmosphere and all in aid of some deserving charity cause.

Yes, a wonderful band of magicians doing a wonderful work for charity. And, as I leave their den close on the hour of midnight—after a puzzling and pleasant evening—I still ask myself:—"Who are 'The Five Demons'?"

IF YOU HAVE ENJOYED THIS ISSUE

Why not have RADIO AND HOBBIES delivered to you every month? Then you run no risk of missing an issue, which may contain something of special interest to you. Order your copy of RADIO AND HOBBIES from your local newsagent, or direct from us, at 60-66 Elizabeth St., Sydney. It will cost you only six shillings a year.

TROUBLESOME TONGUE TWISTERS

THE increasing popularity of Tongue Twisters with all to-day, both young and old, together with the knowledge of the good, wholesome fun they produce at parties, in the office, home, and even over the radio, has led me to give you half a dozen simple ones in the hope that you, too, will find them Truly Terrible Troublesome Tongue Twisters.

You will have some enjoyable fun in getting your friends to repeat each one ten times quickly. Try them yourself first if you like. You will be surprised at the result of your efforts. Now, each one ten times—quickly.

"Mixed biscuits."

"Soiled shoes and socks shock Susan."

"A cup of coffee in a copper coffee cup."

"Gaze on the gay grey brigade."

"A glowing gleam, growing green."

An old lady, passing through a dockyard one day, and seeing a sailor copper sheathing some boats, asked him what he was doing to the boats. He answered: "I'm copper bottoming them, mum!"

Now, repeat the sailor's answer ten times—quickly.

"DANTE" RETIRES
Successor Named

HERE'S real magical news for you. Just as we go to press I received the news from London that the Great "Dante," who appeared in Australia some few years ago with his stupendous magical revue, "Sim Sala Bim," is to retire at the end of this year—and so another great magician lays down the wand in peaceful and comfortable retirement.

Greatest of all is the news that Dante has selected an English magician to succeed him with "Sim Sala Bim"—the huge and sensational magical production that Dante for so many years appeared with in many parts of the world.

There have been several successors from Hermann to Dante, ranging from Hermann to Kellar, Kellar to Thurston, Thurston to Dante, and not one of them a Britisher. Now the long and honored line is to be broken by an English magician to take over the crown of Dante and "Sim Sala Bim."

Prior to this, the name of the English performer was Merlin, but henceforth, in taking over Dante's show, his name is apt and appropriate, for it is near enough to Dante—actually it is the first half of Dante and the last half of Thurston.

So we look to the future and the continuation of "Sim Sala Bim," guided by the seen and unseen hand of the master, Dante.

Danton, we greet you, and wish you well.

AN AMUSING "CATCH"

PLACE a glass upside-down on the table, and beside it lay three wooden matches. Challenge your friends to lift and place on top of the glass one of the matches with the help of the other two matches ONLY.

It will not be long before he has succeeded in placing the match on the glass, probably with the remark, "That's easy." But, is it? Say to him, "I knew you couldn't do it. I told you to place the match on the TOP of the glass—NOT the bottom of it."

MATHEMATICAL PROBLEM

HOW would you cut a tape measure, 33 inches long, to divide it into two parts, one to be three-fifths the length of the other. (Answer will be published in next issue.)

Hey Presto! Abracadabra!

Again—thank you for your kind letters.

Answers to my puzzle in our June issue are still coming in. I will still send a FREE book to all who send in correct answers to any of the puzzles I publish in this journal.

I think it is a good idea for as many as possible to take the opportunity of corresponding with pen-friends of magic interest. There are many who do this I know, for they have written to me and told me so. I still have on hand a few names of our readers who would like pen-friends. Send me your name and address if you would like a pen-friend, you will add much to your magic interest and learn of the doings of others interested in the same hobby as yourself.

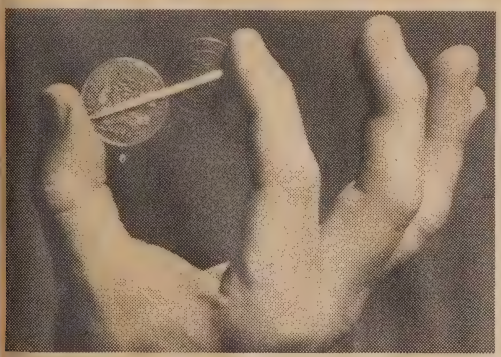
Many amateur magician readers of this page have sent in their photographs and programmes, but I would like more of these, so that we can have a real photographic display of those whose hobby takes them to magic entertainment. Come on magicians, let's have a photograph of yourselves. I have one of a girl ventriloquist, and later on I will tell you more about this very capable performer. For the present, I will tell you this—she is only 12 years of age, and has a wonderful ventriloquial doll. She has appeared at school concerts and other concerts and . . . well, I had better leave the full story until more space is available, when I will be able to tell you about several other talented magicians who are readers of our Magic section.

SPECIAL: Look out for the puzzle in this issue. Send in your answer and try to win the FREE Magic book.

With best wishes Magicians,
Yours Magically,

Barry Kent.

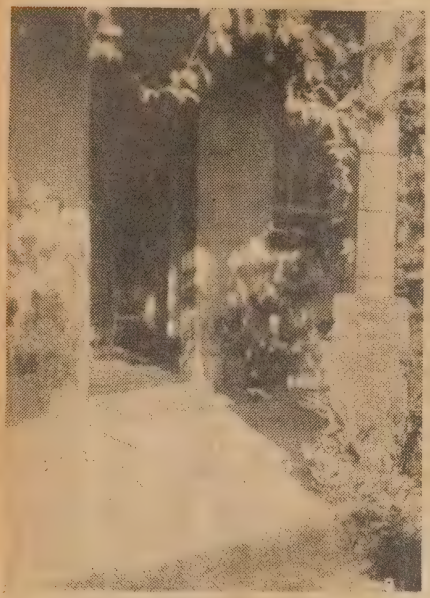
THE BALANCING COINS



THE SECRET. Use a toothpick or match stick just a little longer than the diameter of the two coins. This is placed behind the coins and gripped between the thumb and forefinger, where it makes an unseen support for the coins.

Baffle your friends with this. Try as they will, they cannot perform this difficult balancing stunt. The coins may be borrowed but should have edges which are not rounded or worn. One coin is set on the other and then balanced between the thumb and finger. This will seem impossible to the onlooker.

WHAT'S GONE WRONG WITH THESE?



This photograph would be much more attractive if printed on cream paper and diffused so that it has a misty effect. It would be 100 per cent. better if there were a rocking-chair on the left-hand side (showing only about two-thirds of the chair) and some knitting on the seat of the chair, put there carelessly. As far as the mechanical details are concerned, the light was too bright, the contrast, therefore, too great. There is heavy shadow on the top and right side and brilliant lighting at bottom left. A better plan would have been to wait for the sun to go behind a cloud and give a longer exposure. The lighting, then, would have been much more even all over. As it is, the photo has no purpose. It tells no story. If, as explained in the first paragraph, there was some unfinished knitting and, say, a book, on a chair (and these stage-effects must be emphasised in the photograph—that is, they should loom so that the eye travels to them immediately), it would tell a complete story.

There is practically nothing that can be done to improve this picture. In the first place, the photographer, for some unknown reason, has included in his picture (in the foreground) some sort of plant-life. It is badly out of focus and clutters up the picture. If it is not possible, in cases like this, to lift your camera higher than obstacles in the immediate foreground, don't take the picture at all. Move off and take it from another angle. Then, again, I should say that the whole photo is under-exposed. There is good detail in the background; but it is barely perceptible because of under-exposure. All in all, it is difficult to know just why the picture was taken. It has no value. But very often, blue sky and greenery misleads amateurs. Therefore, always remember this—a picture in black and white never looks so attractive as it seems in the viewfinder. Always make allowance for that.

This is a classic example of waste. A minute's thought on the part of the photographer would have convinced him that the boat was too far away for anyone on it to be recognisable. And the whole picture means nothing, anyway. Obviously, the photographer got a sudden impulse to take a picture, whipped out his camera, and blazed away without thought of exposure, effect, or anything else. Also, the top and bottom left-hand corners of the negatives are fogged; obviously light is getting into the camera via the filmpack-holder light-trap. Always choose your picture carefully; have a reason for taking it. Then take it carefully. It must be remembered, too, that good pictures are not a matter of luck. Amateurs, seeing, perhaps, an excellent photo of a youngster feeding a wallaby, might think, Gosh, that looks easy; or was he lucky? The chances are about 500 to 1 that it was neither easy nor lucky. The photographer might have waited anything upwards of half a day to get just that one picture; and, in getting it, he might have taken twenty or fifty pictures.

The geatest asset of a photographer is patience. Apparently, when this picture was taken, the taker was considerably excited at the prospect of getting the young hopeful in the same picture as a wallaby. All very nice, too. But he couldn't wait long enough. The result is that he has neither a good picture of the young hopeful, nor a good picture of the wallaby—which is quickly disappearing out of the side of the print. So these are the two things to learn.

ART OF TAKING INTERIORS

Some Things To Remember

"Everyone envies a good interior picture. Actually, it isn't so hard to take such pictures if you know how. Now I was talking to Frank the other day and he was asking me about photography indoors, and I said—"

RANK dumped his golf-bag on my work-bench, and hoisted himself up beside them. A few seconds later he discovered that he had sat in a pool of ter. When everything had returned to rmal, he said, "Listen. Listen, everye seems to be taking shots inside these ys—shots of something or other. Now, u don't have to believe it, but I also ve tried; and, surprisingly enough, the sults weren't exactly 100 per cent. In ct, to be strictly truthful, I'd say they re about, roughly, two per cent."

AND CAMERA ESSENTIAL

I explained to him carefully that terior-work needed a great deal of re, a little knowledge, and some exrience. "First of all, you must use a and-camera—or, at least, one which lows you to set up your instrument a tripod and focus your subject on ground-glass screen.

"It's possible, of course, to get picres inside with a smaller, less expenve roll-film camera; but it requires a eater measure of expertness. Very ten, too, you will find that you need wide-angle lens—that is, one which ll photograph a wider area of your bject than would an ordinary lens. it then, again, you need to use a lot care; because wide-angle lenses dist perspective—and, on top of this, e subject on each side of the picture ay they are columns, or something nilar, for example), fan out.

"If you happen to be making a picre of, say, an Art Gallery, that has ws of columns, the centre of the room gallery—which is obviously the best ace to set up your camera—is, actuly, the worst—particularly if you are ing a wide-angle lens. Because, if ou're in the centre, the columns on th sides will fan out oval-wise.

OSITION IMPORTANT

"On the other hand, if you take up a osition on one side of the gallery, so iat on one side of your picture the olumns march one behind the other, the olumns on the other side of the gallery ill be normal. In this case, your picre will have, on one side, only one olumn (the others, all ranged accurely behind it, will suggest a row, beause of those on the other side of the oom)."

He nodded slowly. "But what would be doing in an Art Gallery?" he asked. Except if I went in there to get out of the rain—and it's ten to one I would have a camera with me under those circumstances."

"All right. Supposing you want to take a picture in your own home," I suggested. "A dining-room, or living-room scene. There are a few rules that have to be followed. Set up your camera, then, when you look into the focusing screen, make sure there aren't any pieces of furniture on the edges—and particularly on the corners—of your picture.

"That's important. It is also important to remove all prominent objects away from the front of the camera. If you don't, you'll find that they will dwarf everything else in the picture.

"Here, too, if you're using a wide-angle lens, you'll need to be very careful. Take your picture so that it is flat as it faces the camera. By that, I mean don't set up your camera so that it is pointing towards a corner of the room. For those two converging lines—that is, the walls, converging on the corner—will reproduce as the columns did—fanwise. The same thing goes for a corner converging towards the camera."

Camera notes by George White

Frank thought for a minute. You could almost hear him thinking. Then he said, "All right. Now what about lighting?"

FOCUS WITH LARGE STOP

"If the sun is shining strongly outside, that isn't so good. It throws too much heavy light and too many dark shadows," I explained. "You want a subdued light outside; then the range of lighting is more even, although, perhaps, darker. In that case, of course, you need a longer exposure. If you are photographing the interior of a small room which is badly lighted, you might have to burn a few inches of magnesium ribbon, or shoot off some flash-powder, to light up the dark parts. But, if you do this, be careful not to burn your powder or ribbon in a direct line with the camera.

"There's another thing, too. When you're focusing, do so on a large stop—that is, have your aperture as wide-open as possible; then, when everything is satisfactory (remember, I'm speaking of the reflex type of camera), stop down to about f/16, or even f/32."

"Why?" he asked. "In the name of heaven, why? Don't you have to give a longer exposure when you stop down?"

"Yes. But, by stopping down to a small aperture, you bring everything into focus—everything from the object right in front of your camera, to the one which is farthest away. Try it out in the open, and watch the foreground come sharper as you stop down your lens.

"In this case, of course, when you twist your lens to f/32, the image on your focusing-screen will be very, very dim. So it's practically essential to examine it on the screen through a magnifying-glass—that is, unless you use f/32; in which case, everything ought to be in focus. But if you use f/16, make sure first—with a glass.

"If the room is very dark, have someone start at the other side of the room with a torch pointing towards the lens, and move slowly towards you while you're looking into the focusing-screen. In that way, you can make sure that the light is in focus all the way across the room.

WATCH HALATION

"Halation is something you've got to watch; although, with nearly every film and plate backed—as they are to-day—you don't have to worry so much. However, don't photograph windows on which the sun is shining; or at least cover them during the major part of the exposure. Then uncover them and give another exposure of a few seconds. This is particularly the case, of course, when there is a fine view through the window.

"There is only one other thing to remember—this: keep your lens perfectly clean, both inside and out. If you don't you'll get a misty effect, or one which looks very much like halation—which means what it says, namely, a halo.

"You can't lay down any rules for exposure. They differ widely with the amount of illumination, the time of the year, the state of the weather, the number of house lights, the size of the room, the color of the walls, floor, ceiling—in fact, nearly everything has an effect.

"Only practice can tell you what to give. But it's always better to over-expose slightly than to under-expose."

"Like a steak," he said.

I nodded. "Or a golf score-card."

THE USE OF REVERSE FILMING

makes marvellous athletes

By FRANK EASTMAN

There is no need to envy the wonderful trick effects obtained by professional movie men. You can film some excellent trick shots by taking a little care, and they will be just as effective. This article tells you how to do it.

LAST month, on this page, we discussed the miracles performed by the professional films, and the work of the special effects departments in the Hollywood studios.

This month, it is proposed to outline various cinematic tricks which can be achieved with the cheapest and simplest of movie cameras. This distinction is made because the manufacturers of the expensive cameras, such as the Cine-Kodak Special, make a special feature of its "trick photography" appliances.

The Cine-Kodak Special, for instance, has various masks for multiple exposure, a special wind-back crank for double exposure, and lap dissolving, a "one-frame" mechanism for animation, and a host of other gadgets. But—and this is a big "but"—this type of camera costs something in the vicinity of £150, and the accessories will run into another £100. If you are a millionaire, this outlay will mean nothing to you. But in that event, you will not be reading this article, and so we start off from scratch!

SPECIAL CAMERAS

"Special effects" cameras, as they are known in the Hollywood studios, are entirely different from the boxes which photograph the main action of the film. Whereas, in the "floor" cameras, the greater part of the expense goes into the lenses and filters, the "Special Effects" cameras rely more upon actual mechanical ingenuity. These cameras may cost anything from £2000 to £4000.

Therefore, it is rather superfluous to point out that the amateur, with his 8 mm. 3.5 lens camera, costing £12, cannot hope to emulate the elaborate tricks of the Hollywood studios. And, to digress for one moment from our main topic, the idea that a cheap camera will perform Hollywood tricks lies at the root of all bad amateur movies. The amateur cinematographer becomes either over-ambitious or discouraged.

In the first case, he attempts to emulate the work of the professional cameramen and, because he does not realise the limits of his machine, turns out work that is ludicrous and baldly pretentious. Or he goes to the other extreme, and turns out reel after reel, most of it badly exposed, lacking in continuity, and stilted in both thought and action.

An effective stunt is the bicycle which raises itself from the ground at its owner's bidding, and runs forward to meet him. Actually he pushed the bicycle away from him. Filmed in reverse, this shot was then preceded by one of the boy walking down the steps.

Do not expect your camera to do too much. On the other hand, do not look on it as a toy. A toy of which you become tired after the first few months. Movie cameras are expensive, but they are—or should be—a lifetime investment. Therefore, any article on special effects with cine cameras must be prefaced with this advice. Purchase a camera within your own price-range, and get to understand it thoroughly! Learn just what it will do and what it will not do. The result will be greater fun from your hobby and infinitely better films. Always remember that it is not the equipment, but the brains behind the equipment, that makes for fine amateur movies.

Let us, therefore, assume that you have a cheap camera, and you know your machine inside out. The first trick you will want to try out will be that of Reverse Filming.

What is Reverse Filming?

REVERSE FILMING

Let us illustrate it with a well-known example. A news-reel shows the shot of a demolishing of a tall chimney. The chimney crashes to the ground amid a shower of dust and flying bricks. Then the voice of the unseen commentator asks the camera-man to replace the chimney—and immediately, the chimney reforms in front of our eyes and springs up to its original position.

Or a swimmer may make a particularly spectacular dive. He glides through the air, cleaves the water, and disappears. Then, as we watch, the splash suddenly folds downward, the diver reappears, legs first, to land gracefully back on the diving board.

Camera magic? No. A camera trick! Reverse Filming merely means filming the action with your camera turned **upside down!**

Now, follow how this works out. The camera, turned upside down, films all action backwards. If the film were run through the projector like that, all action on the screen would be in reverse and upside down. Now, we want the action in reverse (i.e., the diver re-

ing action or the chimney replacing
f), but, naturally, we don't want it
de down on our screen. So, when
film returns from the processing
on, get out your editing board, clip
section of film, and replace it into
roll **right side up!** In other words,
the action is reversed, but the action
ight side up and normal.

ME SIMPLE TRICKS

pace does not permutations
he Reverse Filming trick. They are
on! Reverse your camera and film
oy pushing a bicycle away from him
then beckoning to it. On the screen,
young wizard will appear to beckon
bicycle, which immediately springs
from a prone position, and bowls
ight into his arms.

everse your camera and film your
ject throwing a vase of flowers into
air. On the screen, it will leap out
the air and into his hands. Lighted
tches do the same thing.

re you athletically minded? Then
this shot in reverse filming. The idea
to establish your camera on some
d support and make two shots of
athletic friend jumping off the
of a high wall, so that on the screen
will appear to have jumped entirely
the wall. It can be a fifteen-foot
ll if you like—the higher the more im-
ssive.

OW IT IS DONE

Here's your process.

With your camera right side up, get a
t of your friend starting to run to-
rd the wall. Now, have him climb to
top of the wall, and stand there.
ld the camera upside down, and film
n jumping **backwards** off it on to the
und. Now, hold your camera right
y up again, have your hero mount the
ll a second time, and jump forward
wn on the other side.

Now, when your film is processed, edit
like this:—

Shot 1.—Man runs forward to wall.

Shot 2.—He flies upward through the
and lands on top of wall. (This is
ur reverse shot turned upside down
d spliced in right way up.

Shot 3.—Man jumps down other side
wall.

Such a shot as this will earn you the
le either of a super athlete or a cam-
wizard. And, lest you think that in-
ducing trick photography into ath-
ics is hardly playing the game, may
remind you that practically every
e of Douglas Fairbanks's stunts in
silent pictures were worked in ex-
tly the same way as the trick de-
ibed above.

Those readers who can remember the
ent Fairbanks pictures, "Mark of
rro," "Robin Hood," and "Thief of
gdad," will recall the incredible leaps
d jumps of the hero. Fairbanks scaled
lls, sprang from roof-top to court-
rd, swung from dizzy heights, not by
awn, muscle, and timing, but merely
reverse filming. And although we
like robbing Hollywood of too much
amor, let us finish by saying that
hnny Weismuller's Tarzan leaps
rough jungle trees could never have
en accomplished without the aid of
verse filming.

This idea, incidentally, is worth more than one sequence. Many movie makers have built up entire comedy reels from it—such as the story of the slothful individual, who, after one cake of yeast or other stimulant, proceeds to bound over great obstacles like a terrified Spring-heel Jack!

Next to Reverse Filming, the most popular trick with amateurs is the "Stop-Action" technique.

This trick was recently exploited to the full by the professional studios in "Topper" and "Topper Takes a Trip." Two people become spirits, you will remember, and return to earth to make things unpleasant for Roland Young as Topper. Being invisible, they work all sorts of mischief. Poor Topper puts his bowler on a chair. In front of our eyes, it disappears. He dances with Constance Bennett. In a flick of an eyelid, she vanishes from view.

KITTEN BECOMES ALSATIAN

An amateur movie viewed recently used the same idea—incidentally, this was filmed months before the Topper pictures. A young man discovers a book on magic. Studying it, he determines to try out the secrets. He gestures to a table laden with food. Immediately, it disappears. He waves his hand again—and there it is, back again! Next, he proceeds to point to the various dishes. One by one, they vanish.

Next, he comes upon a man trying to start a dilapidated T model Ford. A gesture—and the Ford is transformed into a streamlined racer. He sees a tiny kitten frightened by a dog. A movement of the hands, and the kitten becomes a savage Alsatian.

To accomplish these effects, the cameraman first placed his camera on a solid support. The young man was filmed walking toward the laden table. He gestured towards it, then froze in that attitude. The camera was stopped at once. Then the table was removed from the picture, the young man went on with his movements, as the camera re-started. Thus, in one frame the table was there. In the next it was gone. On the screen, it vanished in the twinkling of an eye!

The apparent miracles with the old car and kitten were accomplished by the above method, plus substitution. In other words, when the camera stopped, the Ford was driven off, and the racing car placed in exactly the same position. The same thing occurred when the Alsatian dog was substituted for the kitten.

The success of this trick relies on two things—the steadiness of the camera and the subject, and the placing of the

(Continued on page 75)

The spectacular leap, as outlined in the article, was accomplished by the boy jumping off the wall, and being filmed in reverse.

John Cavill runs his eye over Mr. Hull's model. "A real plane," was John's verdict.

Further details are given in this article on the petrol-driven model plane, which we have been testing during the last few weeks. The finished model gave no trouble at all, and produced good flights right from the start.

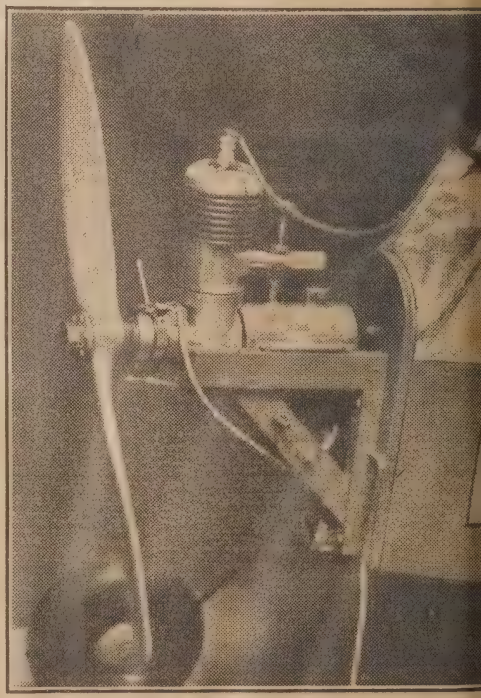
A PETROL MODEL AT CLOSE RANGE

IN the July issue I told you how I had taken to building a model aeroplane, six feet across, and driven by a small petrol engine. That particular plane has now been finished, flown several times, and I am hard at work building a second job. I say, "hard at work," but actually I should say, "enjoying to the full," for I find the job a most pleasant and interesting recreation.

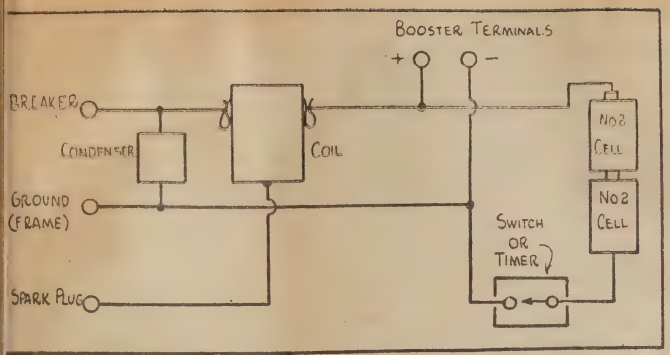
From what I can see of it, the building of a six-foot model is definitely easier than building a smaller one. The work is not so "finicky." You can get your fingers on to a quarter-inch spar properly, but you want to be a watchmaker to appreciate fiddling with spars thinner than matches. That's how I look at it, anyway.

I wouldn't like to build a big model from small diagrams or without proper instructions, but there are no problems when you are using a well-tried and thoroughly recommended American kit of parts. You simply can't go wrong, and you don't have to stop every now and then to scratch your head and puzzle out things.

I'm sure a few of the local boys have the wrong idea when they build a model "out of their heads," and think they have saved five or ten shillings by buying all the wood and parts individually. For thoroughly experienced builders it may be O.K. to buy the bits, but my strong recommendation to anyone starting in the model plane game is to get the fundamentals right by building up a recommended kit.



A close-up of the petrol motor and its mounting. The petrol tank is at the rear. A cowling covers the engine, but has been removed for this fine picture.



n case a booster battery is required for easy starting, this circuit diagram shows just how it is fitted.

By
A. G. HULL

thorough study of American pub-tions giving results of contests over re shows that at least two of the s available here are capable of being ord-breakers if assembled according directions. These are the Megow aker Flash" and the "Comet Clip-"

Of the motors available, the two apest are the Bunch "Mighty Mid-" and the Brown Junior. Model D. ecked from several directions, there 't any doubt that both these little tors are capable of giving splendid formance, with an almost unlimited

n practice, the motor is allowed to n for less than a minute during each ht. In this time the model climbs the ground and flies to a height between 500 and a thousand feet, to le to earth several minutes later.

Y EXPERIENCE

A few words about results with my omet Clipper" may not be out of ce.

t took exactly 48 hours of spare ie to get the job finished, lacquered, d ready for flying, with the motor rcu hly tested and carefu ly run-in. mmediately on completion, the model s given some gliding tests in a local k, but, as there was a 20-mile-an-ur breeze blowing, it wasn't long be-e these were concluded with a broken peller.

Next day the model was taken to a le-open space near Blacktown, and wn with a propeller which I cut to ape the previous evening. Hand-unched, the model climbed too steeply d eventually "stalled," tail-slipped, d then nose-dived. Just as it ap-ared certain to crash it flattened out and climbed again until it stalled. This stunting was repeated several times, until the motor stopped, and a perfect nose-dive from about 75 feet gave an exhibition of a "perfect" crash.

But, due to the remarkable crash-proof design of the model, no damage was done.

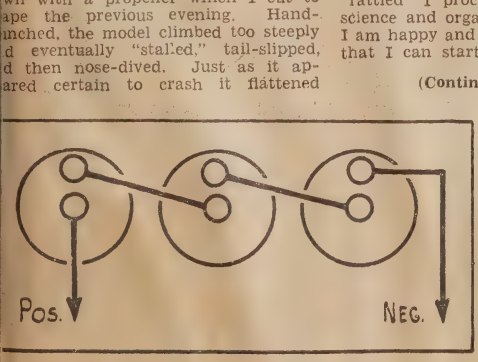
Moving the batteries forward has since stopped the stalling tendency, and many flights have since been made, and, so far, nothing broken.

STARTING THE MOTOR

As remarked in last month's issue, one of the features of a recent contest for petrol-driven model planes was the amount of ineffective twiddling done by several competitors who were having trouble in starting their engines.

Having at one time possessed a racing outboard speedboat (which had broken my heart with its habit of getting stub-born every time a race was due to commence but always docile at other times), I was rather apprehensive about my "Mighty Midget" motor. For a few days it seemed certain that this little engine was going to be sulky. But be-fore giving it a chance to get me "rattled" I proceeded to apply a little science and organisation to it, and now I am happy and proud in the knowledge that I can start it at any time I like,

(Continued on page 74)



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Bunch, Mighty Midget and Gwin Aero ; Brown Jr. and Husky 1/5 h.p. Petrol Motors. Write for prices.

Send now and get your "Red Zephyr" by return mail.

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Please send me (*a*) *Free particulars.* (*b*) *Scientific "Red Zephyr" Kit.* I enclose £3/6/-.

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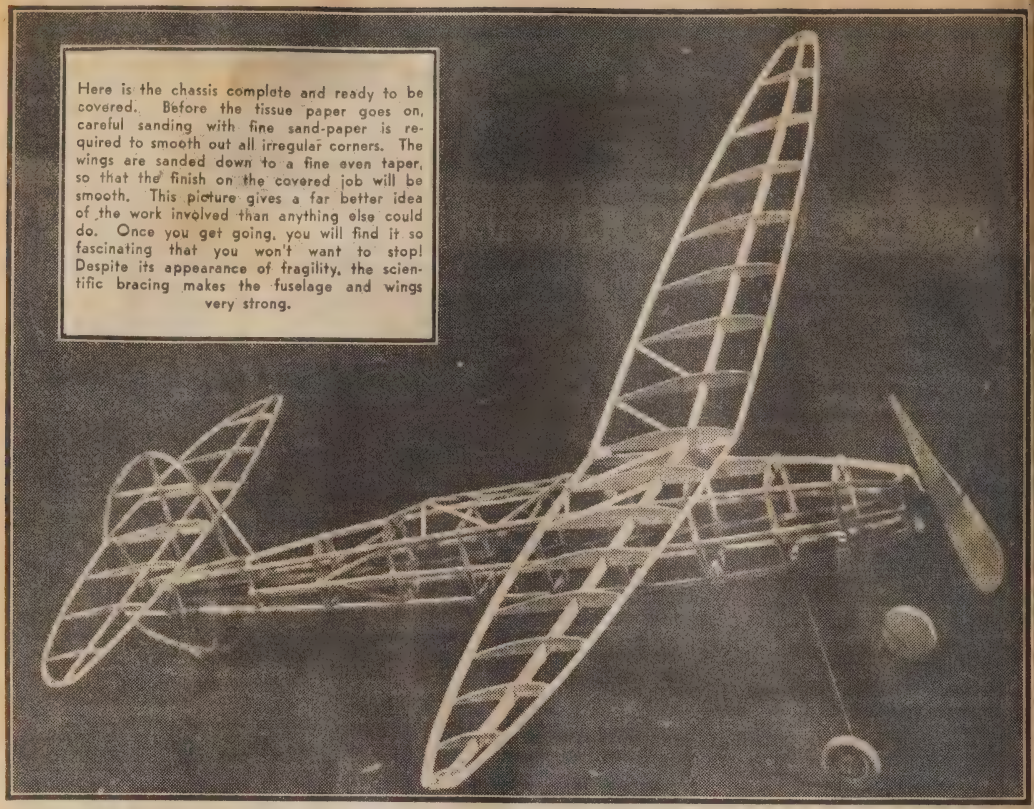
Comet "Clipper" Kit, as supplied to "Radio and Hobbies" magazine, £3/7/6 plus 3/- freight.

Victorian Distributors: AUSTRALIAN ENGINEERING AND EQUIPMENT CO., Melbourne.



Here is the chassis complete and ready to be covered. Before the tissue paper goes on, careful sanding with fine sand-paper is required to smooth out all irregular corners. The wings are sanded down to a fine even taper, so that the finish on the covered job will be smooth. This picture gives a far better idea of the work involved than anything else could do. Once you get going, you will find it so fascinating that you won't want to stop! Despite its appearance of fragility, the scientific bracing makes the fuselage and wings very strong.

START WITH A RUBBER-DRIVEN PLANE

THEY ARE SIMPLE AND INEXPENSIVE

The thrills of modern flying are many. Not the least of them are to be found with the original type of model plane—the rubber-driven machine. Modern technique and materials now enable you to make rubber models which will give an astounding performance, and look like the real thing.

THE pioneers in the model flying game had no idea that, some day, things like balsa wood and fuselage construction would ever come into being. They fashioned planes from anything they could get, with a single stick for the fuselage, and anything from bamboo to piano wire for the wings.

The beginner nowadays doesn't have to follow this heartbreaking path any longer. The popularity of model flying, particularly in America, has produced a technique which allows not only exceptional flying to be the rule, but planes which look just like the real thing.

Naturally, these planes take more time to make, but there is nothing really difficult about the job. There are more bits to put together, but patience is cheap, and one does see something for his efforts.

KIT OF PARTS

The purpose of this article is to say something about making up a rubber-driven plane from a kit of parts. For the beginner, this is probably the best way to make a start, because all the hard parts of design, &c., are already worked out for him.

The design of model planes isn't a haphazard thing at the present time. All the well-known kits of parts can be relied upon to build up into models which will fly, if the instructions are carefully followed. The more expensive types must be good, otherwise they wouldn't sell, and the cheaper types are cheap mainly becau there is less material the design follows t same approximate line

So you don't ri much when you st out with a kit worth few shillings.

WHAT YOU GET

The most important thing you get your kit of parts is a full-sized pl drawing of everything, generally on o large sheet. Everything you want know is printed here, with close-up a sectionalised drawings of any tickli bits so that you can't very well wrong.

Just to see what it is like, we obtain a kit of parts for a 28-inch model pla from one of our city stores, and s about making it up just as the beginn would do. We followed everything r ligiously, and the result of our effort

ore being covered and flown, is photo-
phed on these pages.

With the plan, you get strips and
bs of balsa, enough to make up all
parts. In addition, there is a tube
cement, covering for the wings, a
ik for the propeller (with details of
struction), rubber for the motor
eels, &c. Our kit was complete to
last detail.

Even if you should spoil some of the
gile balsa, you could replace pretty
ll all of it for a few pence, so you
edn't worry about this.

CUT-OUTS, &c.

If you study the photographs, you
ll see that the wings for instance,
e built up of balsa strips, and ribs,
hich are cut out of thin balsa. You
ll find all these parts to be cut out
wings, body, and tail, printed on
thin sheet. All you have to do is to
t them out with a sharp razor
de, and you will find they will fit
o place exactly as shown in the dia-
am.

There is no difficulty about placing
ese sections after they have been cut
t. As our pictures show, they are all
yed with numbers or letters, or both,
d all you have to do is to check with
e diagrams.

It isn't a hard job at all, but the
odel shown here would need a fairly
lid week-end's work to complete.

OME CONSTRUCTIONAL POINTS

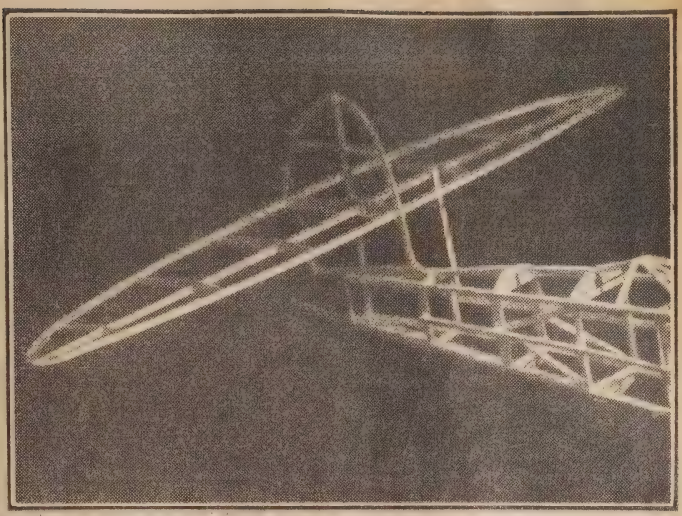
The plan must be laid on some flat
rface, with a piece of grease paper
unch wrappers are good) over it. The
embers for the fuselage and wings,
e., are then pinned into place, bent
here required, and the smaller pieces
ued into place.

For this we obtained a flat piece of
ood one inch thick, and about 30 inches
12 inches. This can be placed across
e arms of an armchair, or placed on
table, and makes work very con-
nient.

If necessary, the work can be left
nned to the board overnight, or when
u have to stop until the next session,
id placed somewhere out of the way.

The cement used for planes dries very
ickly, and five minutes will usually
e a whole assembly quite hard enough
be removed from the board. You can
ly on the instructions to outline the
rious stages in construction, and we
ave found them, on the whole, very
ear and easy to follow.

A kit to build the plane illustrated
st us about 3s 6d complete. Smaller
nd less elaborate planes may be built
r even less than this, but we suggest
at the 28-inch model, or very near
, be regarded as the minimum for a
eginning. The smaller planes are a
it finnicky to put together and, as a
ule, don't fly quite as well.



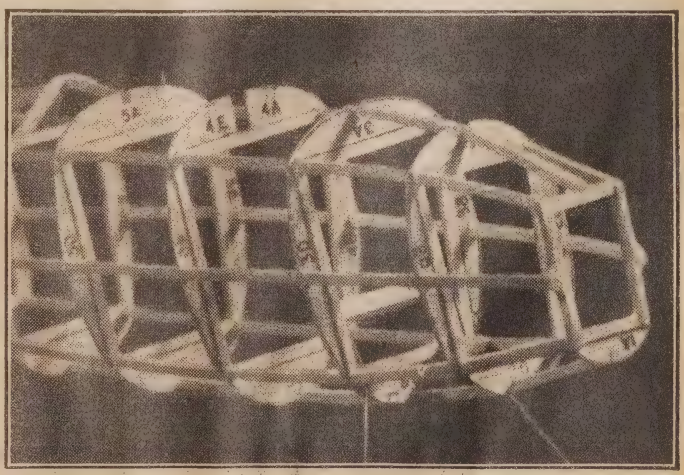
This close-up of the tail and stabiliser gives a good idea of how such parts are built up. The rubber is anchored to a solid wooden plug that fits into the end of the fuselage.

At the other end of the scale you can make models up to 5ft. or so in wing-spread, and these will cost about 15s. Don't be frightened of the bigger planes, because actually they are easier to make and fly than the little ones. It is very important to see that the various parts are free from distortion and warping. For that reason, the flat board and care in keeping everything dead flat from the start are the two most important things.

If you find the fuselage is not dead right-angled in section when you get the main members cemented together, you can generally pull it into shape with some cotton tied round the two members which need pulling together. Keep this cotton there until all the cross pieces are in place, and set, when you will probably find the work will stay perfectly in shape.

The razor blades must be sharp always, otherwise you will tear the wood instead of cutting it. You will probably use up three in making the model shown here.

Not a bad investment for 3s 6d is it?



Another close-up to show how all the cut-outs are keyed against the diagram. If you spoil one, you can easily make another from the full-size outline drawings of each which are generally included on the instruction sheet.

GEARS FOR RUBBER-POWERED MODELS

Sooner or later every model builder, in his quest for more power and longer prop run, decides to try a geared motor. Gears in some form or other seem to provide the answer to the vexing problem of power. But, unfortunately, the question of weight comes in and ruins everything.

LOOKING at the question very broadly the reasoning goes something like this. We can use an eight strand motor in a model and get all the power we need, but find that 500 turns is our maximum.

Now a four-stranded motor would enable us to get 900 or so turns, and practically double the prop run; unfortunately our power is halved and we find that the machine won't take off, or at the most gives a very sickly performance, and comes down with most of the rubber still unwound.

Suppose we hook up two four-strand motors to one prop shaft by means of a geared motor. Theoretically we should get the kick of eight strands and the turns of four strands.

That sounds very satisfactory, but here's the catch. Or, rather, the two catches—friction and weight. Friction cuts the kick down to the equivalent of a six-strand motor, and may cut the efficiency down to zero on the last few turns, while the weight is a double edge sword.

THE WEIGHT PROBLEM

The weight of the gears is at least equal to two more strands (we're speaking of ¼ x 1-16 flat rubber), thus we have the weight of a 10-strand motor and the kick of a six-strand motor, while the increase in weight demands more power. So that instead of our 100 per cent. increase in motored flight which we expected, tests have shown the actual gain to be about 15 per cent., which 15 per cent. is lost in the glide due to the increase in weight.

So that our account shows a gain of exactly nothing, and a loss of quite a deal of work.

GEARS IN THE TAIL

Another system of gears which once showed promise of big things, consisted of a set of gears in the tail, which enabled a double length motor being used in a small fuselage. The idea being to run one motor from the prop shaft to the tail, where it was attached to a gear wheel, and then to run another motor from another gear-wheel back to the nose. When the gears were in mesh the result was a single motor equal to double the length of the fuselage.

The advantages claimed for this system were that the turns were doubled and extra power was gained. Admittedly weight was added, but the prop run was sufficient to compensate that. The big advantage was that the rubber did not flop about inside the fuselage after the motor cut out.

Here again, theory suggested that our troubles were over. But unfortunately practice had a few more spokes for our wheel.

In the first place friction once more reared its ugly head and cut the power down. Then the rubber motors became temperamental, and did not synchronise in unwinding. The result was a most uneven prop run.

The biggest fault of all, and the one which finally caused us to abandon the type of gear, was the frequent tangling of the two motors. Rubber motors swing about a great deal when they are unwinding, and when the two motors caught and became interlocked, the fuselage had to be practically torn apart before they could be separated.

WILL SHE MAKE THE GRADE!

Jimmy Fullarton, Wakefield team member, watches to see whether his model will climb or crash.

Using Acetone Cement

Have you ever tried using cotton wool to apply dope to your model? This is one sure way to eliminate brush marks and secure an all-over finish.

IT is almost always inadvisable t use dope full strength. Thin it wit any acetate or acetone, but be par ticularly careful only to use the dop when the atmosphere is comparativel dry. Moist air will cause the dope t blush, and leave white, streaky marks.

When applying dope to a wing, pi it out flat so as to avoid warping. Don use dope at all on a tail unless yo want it to warp. It is particularl important to see that your framewor is true before you apply the pape covering, and then see that in attach ing the paper you maintain the true ness. If such care is taken, warps wi not be likely to appear.

Colored dopes, particularly if they ar thinned down, are likely to give an un even finish. To avoid this, color you paper covering first, with a dye pre pared by mixing aniline dye with methy lated spirits. When the dye has drie thoroughly apply the dope. In bot cases cotton wool should be used, an with care an excellent finish will resul

Exactly the same procedure can b used on balsa wood. The dye an dope method can be used on a hand launched glider, the finish will be equa to enamel or lacquer, and the mode ever so much lighter.

CLUB NOTES

AUSTRALIAN CHAMPIONSHIPS FOR NOVEMBER

The Model Aeronautical Association is planning to run a series of Australian championships in November this year.

THEY will last over two week-ends and embrace indoor, outdoor and gas model championships. It is also hoped that we will have interstate representation at these contests.

Last year, aided by a grant from the Government, the Model Aeroplane Association and the Model Flying Club organised a very successful series which resulted in many new records, and a feast of first-class model flying.

These Australian annual championships are a feature which should not be allowed to lapse. Accordingly, the M.A.A. has undertaken to conduct the 1939 series once again in Sydney, and at the present moment prospects look very bright. However, the matter should be well and truly finalised by the time the next issue goes to press.

THE "BATS" LEAD IN INTERCLUBS

FOR the second time, the Western Suburbs Bats carried the honors at the M.A.A. interclub contest held at Parramatta on June 25.

This was the second contest in the 1939-40 series, and with two wins in two contests the Bats would seem to be making certain of the result. The aggregate time was 7min. 48sec., not quite as good as their effort in the first contest, but still good enough to keep them in first place.

A great deal of credit is due to Eric Cocks, whose fine flying has helped to put the Bats on the map. Eric has also managed to carry off a few trophies for himself recently, as well as gaining a place in the Australian Wakefield team.

Strangely enough, Leichhardt and Bondi were again placed second and third respectively. Leichhardt, we are sure, are due to break through to first place shortly.

The Butler brothers, Arthur and Les, have been flying very well lately; they seem to have taken out a patent on super climb, and Fred Jones is always likely to establish some worthwhile duration. Which makes just three really good reasons why Leichhardt should finish just a little closer to first place.

For August the interclub contest will be flown at Villawood, the Chester Hill home ground. Villawood is situated round about Lansdowne. From Parramatta follow the Woodville-road, and from Sydney Liverpool-road takes you there. Undoubtedly some of the best model flying in the State is witnessed at these contests, so if you want to see some real flying, come to Villawood on Sunday, August 27.

These Models Fly!

....AND YOU CAN BUILD THEM

Capture the thrill of gas-powered flight with this Flying Taylor Cub. The wing span measures 6 feet and the model has been designed to give consistent stable flights.

The kit contains everything you need and even if you've never built a model before you can still be certain of success with this superb flyer.

The price complete (with balsa wheels) is £3/10/-. With pneumatic rubber airwheels and one single pole, double throw snap switch, the price is £4/2/6.

This is only one of the many gas kits. See the Quaker Flash at £2/12/6.

Power your model with a Brown Junior Motor. The 1/5 h.p. Model D, comes to you at £5/7/6.

Model £3/10/-
Motor £5/7/6

MONOCOUPE
50-inch Giant for 15/-

This super rubber-powered Monocoupe measures 50 ins. across the wings and flies beautifully.

The kit contains everything to make this graceful flyer, including a specially turned nose.

You'll be proud to show the Model to your friends as an example of your workmanship.

Price, 15/-. Postage 1/- extra. Interstate, 1/6.

This Book tells you

All you want to know about Model Aeroplanes. It has over 70 plans of record machines—Gas and Outdoor models, and page after page of Indoor machines—all of them designed, constructed and flown by Frank Zaic. This book and the 1937 edition of the Model Aeronautics Year Book by Frank Zaic Aeronautics Year Book by Frank Zaic Aeronautics Year Book by Frank Zaic

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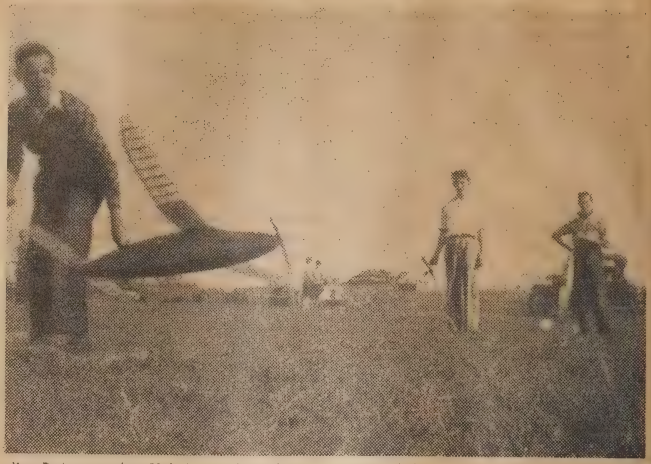


Jim Brown sends off his model in the recent Wakefield eliminations. This model will represent Australia at New York in August.

A PETROL MODEL AT CLOSE RANGE

(Continued from Page 69)

THE FLYING BATTERY

The actual type of torch battery used for flying doesn't really matter, as once the engine is turning over at a few thousand revolutions per minute, it doesn't need much of a spark.

The type of cells to be used is really governed by the permissible weight. Other things being equal, the actual amount of power available from a cell is closely related to the weight. Three units of No. 2 type cells are ideal but heavy. Two of these units work well. A flat 4½ volt battery (type 1000) is O.K. and a lot lighter. Ideal on account of light weight, but not good for more than a few minutes' actual running is the No. 8 unit, which consists of two small cells, giving a nominal three volts.

Normally, any cell will give 1½ volts, but only if the current drain is within reason. When taking 10 amperes from torch batteries the effective voltage at this load is often under half a volt and falls rapidly if the load is imposed for more than a few seconds. The heavier the cells the less will be the voltage drop on the load imposed by the ignition system.

THE LOAD

The full load is imposed on the batteries only when the contact breaker points are closed, so be sure they are open whenever the engine is standing with the batteries connected.

Turning over the motor slowly by hand and spinning it over in futile attempts to start it causes a heavier effective drain than is imposed when the engine is actually running at normal speed.

MIXTURE

As with any petrol motor a reasonably correct mixture of petrol vapor and air is necessary for correct combustion. The mixture is normally controlled by the needle valve jet, but there are other factors to be considered. Firstly, there is the level of the petrol in the tank which will have some effect in the actual amount of petrol vapor drawn into the induction pipe, the petrol vaporising as it is sucked through the jet.

Any air leaks to the cylinder or crank-case will also affect the actual mixture, as explained previously.

Lubrication for the engine comes from oil which is mixed with petrol, the oil being drawn into the crank-case as the petrol vaporises. In motor cycle practice a mixture of one part of oil to eight of petrol is considered sufficient, but the makers of the little plane engines recommend mixtures of one part of oil to two of petrol. In this respect I fancy they err on the safe side, wanting to avoid any chance of under lubrication and I shouldn't be at all surprised if satisfactory results could be obtained with less oil, but I would not take the responsibility of expressing my opinion in this matter in direct contradiction to the makers. They should know!

After each day's flying the tank should be emptied. If it is left for a week or two when half-filled there is sure to be starting trouble. The petrol will evaporate quickly, but not the oil, so that the effective mixture of petrol and oil will become thicker and thicker the longer the tank is left standing with fuel in it.

TECHNICAL BOOK REVIEWS

GRAPHIST'S HANDBOOK

g of the most famous of all tech-ical books on radio is the "Hand- of Technical Instruction for Wire-Telegraphists,'" by Dowsett.

e aim of this volume is to tell the d-be operator all he wants to know t radio for the P.M.G. examina-. It is, of course, published in and, but its contents are equally icable to Australia.

volume such as this, with more than pages, covers such a vast field that adequate recital of its contents is possible.

part from the elementary discus- on radio theory, magnetism, etc., ust cover mathematics, and, of se, the various types of standard smitters, marine and otherwise, h must be understood by the stu-

ie sixth edition, which we have just ived for review, has been brought up to date, and included much erial on the latest types of circuits valves, as well as on the older cir- for transmitters and receivers.

ofusely illustrated and filled with rly and detailed explanation, every o student who intends to take up o as a career will find this new sett a valuable mine of informa-

Handbook of Technical Instruction" wsett), Iliffe and Sons, London, 34s. y from Robertson and Mullens.

* * *

DIO LABORATORY NDBOOK

THER a new angle on radio hand- books is presented by M. G. ggie in his "Radio Laboratory Hand-."

s he points out in his introduction, it eant to appeal to the layman as well to the man with some laboratory wledge and experience. Its informa- is designed to help anyone who es to experiment with radio and o apparatus, rather than the student is learning what radio is about.

, this regard it is a most interesting e book. So many out-of-the-way gs are covered—so many "how to which we can never think of when nped for a simple way out. There about 400 pages, many of which are oted to reference tables on all kinds things.

Radio Laboratory Handbook" (M. G. ggie), Iliffe and Sons, Ltd., 14s.

SEE THEM

you want to see petrol-driven model aeroplanes in flight you will be come at the competitions, held on first Sunday in each month at mbleton.

THE USE OF REVERSE FILMING

(Continued from Page 67)

substituted objects in exactly the same place as the ones removed. If camera or subject move during the substitution, there will be a shifting in the attitude and viewpoint from one frame to another, and the trick will be revealed.

Those who put the achievement of unusual effects above the feelings of their audience, should be able to create a nice sensation of mal de mer by slowly rocking the camera from side to side in unison with their human subjects. The net result is that the same subjects do not appear to rock at all—but everything else does! Everyone who has travelled from Sydney to Manly by ferry knows that the boat rocks more or less while crossing the Heads. If, however, you should travel over on a calm day, when the rock and sway is negligible, you can produce quite a good swell by tilting the camera gently from side to side as you shoot.

These camera tricks are for the owner of a movie camera without extra appliances. But if you are fortunate enough to own a machine with varying speeds and "still picture" device, the field of trick pictures broadens enormously. With the former gadget, you can slow your subject's movements to a graceful dance. Film a busy intersection at half-speed, and you will produce a feeling of terrific panic, especially if you flick the exposure button every second or so. Recall the panic-stricken crowds, rushing, then stopping frozen for a second, then rushing on again, in the earthquake sequence in "San Francisco"? This effect was gained in the manner described above.

Like practically every branch of cinematography, it is not so much the rules as the inspiration brought to them that makes the unusual film. As mentioned before, the permutations and elaborations on the tricks outlined in this article are almost unending. Discovering these new ways to pep up your movie films is one of the delights of this fascinating hobby, and one that will give you many amusing moments when viewed on your home screen.

WHAT WAVELENGTH IS COLOR?

(Continued from Page 15)

of some frogs, if examined under the microscope, are found to possess a coating of fine colorless particles overlying a dead black surface. Yet in sunlight it appears bright blue. The same with feathers of birds. On the other hand, the blueness of deep water is caused in the same way as other colors. The absorption of all other color rays but that of blue.

It may be, therefore, that in years to come we will be going out in our 1000 millimetre hat, or going to bed in our 2 millimetre pyjamas. I don't suppose it would be any more confusing than some of the colors the ladies have invented. Such as elephant's breath, or blush pink. Such titles can be rather uncertain. A lot depends on the age of the elephant or the blushing one. Blue is my favorite color. You know, blue skies, blue eyes, etcetera.

W.I.A. (N.S.W. DIV.) NORTHERN COUNTRY CONVENTION

WATCH next issue for full details of the Wireless Institute's Northern Country Convention, to be held at Newcastle. Competitions and prize lists, dinners, visits, outings, everything at a reasonable cost. All amateurs welcome, and don't forget the special prize for early bookings.

ALLAN FAIRHALL (VK2KB),
Chairman, Committee.

Inquiries to VK2ZC, Newcastle; VK2KZ, Kurri Kurri; or to Secretary, W.I.A., Box 1734JJ, G.P.O., Sydney.

The Baby Set of the Year!

(Continued from Page 39)

indoor aerial, and no doubt will often be used on such. However, as with any set, short-wave reception, which extends down to 16 metres, is better with the bigger outside aerials. The locals will come in well with about 6 inches only, although you wouldn't expect much short-waves on such a length. There is no reason why you shouldn't tack a few turns of wire round the back edge of the cabinet for ordinary use, and hitch up a bigger one if required, for best short-wave results. Such an aerial will be very directional, and you will need to rotate the cabinet to get maximum volume from stations scattered round the city and suburbs.

The 4/39 is going to be a real winner, we know, because you couldn't ask more from a little set. It has everything that a big set has except its maximum volume and bass response. We don't believe it is possible with present equipment to pack better performance into such a receiver. If you can do it, we take off our hats to you.

CURIOSITY IN FIGURES

Examine this novelty. There's mystery in numbers.

0	x 9	plus	1	equals 1
1	x 9	plus	2	equals 11
12	x 9	plus	3	equals 111
123	x 9	plus	4	equals 1111
1234	x 9	plus	5	equals 11111
12345	x 9	plus	6	equals 111111
123456	x 9	plus	7	equals 1111111
1234567	x 9	plus	8	equals 11111111
12345678	x 9	plus	9	equals 111111111
123456789	x 9	plus	10	equals 1111111111

FACETIOUS

Teacher: "Does any word contain all the vowels?"

Pupil: "Unquestionably!"

HOW TO DRILL HOLES IN GLAS

A SIMPLE CERTAIN METHOD

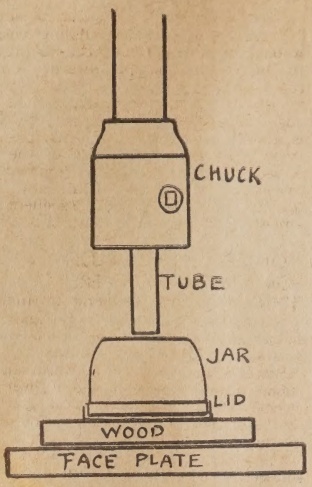
IF we had a stock of "write-ups" equivalent in number and quantity to various articles we have seen which deal with the drilling of glass —then perhaps we could forget writing for a while and work the "rig" now and then, or run off a few points from our rapidly accumulating miniature negs!

Mr. B——— is a keen and scientific horticulturalist who came to us with a problem and two shallow glass jars. For reasons best left with the art of raising pangeraniums or perhaps cuttings of appendix, he wanted an inch hole drilled in the bottom of each jar!

A problem indeed, but the holes were drilled—here's how we managed:

We remembered that glass is never actually "drilled" or "cut"—it is rather ground away or weakened at the required position, and then broken away. We worked on the first-mentioned method, which, of course, is applicable to other forms of glass articles.

The jars originally contained a domestic cleaning compound and were fitted with metal lids; the first step was to tack one of these lids to a



Illustrating the "set-up" for drilling holes through thick glass.

flat board, push a jar into this lid, lay the whole caboodle dead in centre of a large power drill face

A short length of copper tubing was trimmed square and a few no were cut into one end—hereafter the business end. A mixture of oil coarse emery powder was then pa into the tube, which was then cla in the drill chuck.

The feed mechanism of the was disengaged so that it would under its own weight.

All that remained to be done w centre the business end of the c tube on the jar, start up the ma and set a slow speed—about 100 It took one hour per hole—but were inch holes in quarter-inch gl and there was no need to keep an e things.

The resultant holes were beaut clean and true—the secret, of c lies in the use of copper tubing 10 gauge), which, being soft, all grains of emery to embed themselv the end of the tube. As the tube filled with oil and emery, there an automatic gravity feed of fresh ting compound.

HOW TO GRIND DRILLS FOR SPECIAL JOB

AS a rule we find that text books on workshop practice deal only with straightforward jobs and orthodox methods of handling tools.

It is the true craftsman who has the ability to successfully accomplish a difficult job with tools working often as they were originally not intended to do.

Take, for instance, drills: We are all more or less familiar with the common twist-drill, its uses and the methods for grinding the cutting edge. Haven't you noticed, however, that it is wellnigh impossible to drill a true circular hole of decent size in thin sheet metal? This is because we use a drill ground in the usual manner (Fig. 1), which cuts a hole (or a countersink) of more or less pentagon shape. When enlarging holes, too, especially in brasses, bronzes, and other soft materials, a drill ground in this manner takes too heavy a cut, with consequent "grabbing" and drill breakage.

All of the foregoing bothers can be minimised or eliminated if we grind down the leading edge of the drill until it has practically no "rake" or clearance. (Fig. 2) A drill ground in this manner will cut slowly, and plen coolant (soapy water) should be during the process, but the resu hole or countersink will be clean accurate.

For no immediately apparent rea drill will often run hot and bind this case invariably you will find the side clearance of the drill is away. The only remedy for this of affairs is to shorten the dri grinding back until the worn s of the clearance disappears. F shows how side clearance is pro for by a raised edge on the drill fl

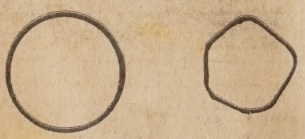


Fig. 1. Left: Hole cut with properly ground drill. Right: Hole made with standard drill.

Fig. 3.: How a raised edge on drill flutes are provided for clearance.

HAVE YOU A SUGGESTION?

How often have you found out some simple procedure which has made your work easier? Or made up some tool to cut down time on an awkward job? We will publish your hints in our pages if you send them along with a simple, clear diagram. Payment will be made according to the length and interest of the article when published.

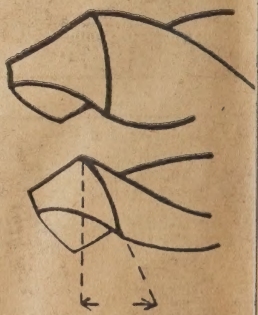
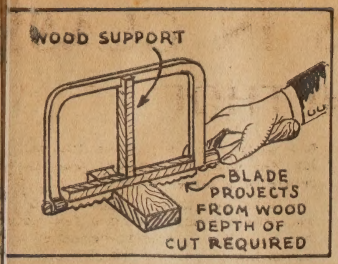


Fig 2: Grinding a drill for a clean in sheet metal. Correct grindin shown in the top diagram.



HANDY HINTS

By W. G. NICHOLS

ADAPTING COPING SAW FOR SHALLOW CUTS

AN ordinary coping-saw can be simply adapted for making shallow cuts in wood if it is first reinforced to prevent the blade from bulging inward. A narrow strip of hardwood is wedged in the frame so that it presses against the top edge of the blade, the amount the blade is allowed to project from this piece of wood is equal to the depth of the cut. A second piece of wood is jammed between the top of the coping-saw and the first piece of wood. Excellent tile effects can be obtained with this saw.

* * *

NON-DRIP PAINT BRUSH FOR CEILING WORKERS

THIS device is a godsend to amateur painters, who usually get paint or kalsomine dripping down their arms whenever they paint a ceiling.

Simply cut a wide band from an old rubber inner tube and slip it over the wooden part of the paint brush, pushing the band on till it goes about one-quarter the way up the bristles.

The pocket formed by the rubber band will catch the dripping paint and automatically empty next time the brush is dipped in the paint.

* * *

SPRING TOOL HOLDER

A convenient method of holding tools in place on the back board of your bench requires only a length of screen door spring. Using staples, fasten the spring to the back board of the bench at different points allowing the necessary room for each of the tools which are later to be inserted behind the springs. The firmness with which each tool is held stops those annoying rattles usually noticed when heavy work is being done on the bench.

* * *

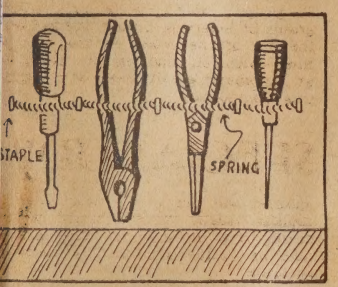
A HANDY ANVIL

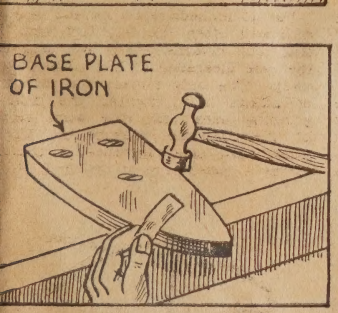
The base plate of an old discarded electric iron can easily be adapted for use as a handy anvil that will lend itself to many applications in the home workshop. Dissemble the iron till you have the base plate bare, then drill three holes through the plate in such a position that when mounted on the bench the point of the plate will project over the edge of the bench. Countersink these holes so that the wood screws used to fix the plate to the bench will finish flush with the plate.

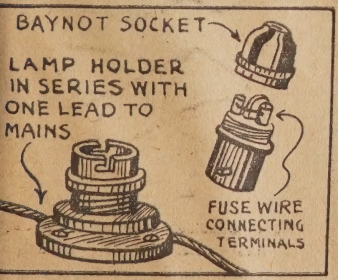
* * *

FOR ELECTRICAL EXPERIMENTERS

When experimenting with electrical apparatus you can obviate the risk of plunging the whole household into darkness by installing this simple little fuse. Connect an ordinary lamp socket in series with one lead of your flex going to the power supply. Now take a bayonet plug and connect a piece of fuse wire across the two terminals and replace the screw top. A couple of these spare fuses can be kept on hand so that in the event of a fuse blowing all that is necessary is to remove the blown fuse and plug in a new one.







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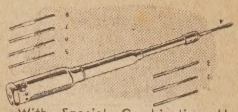
PUSH DRILL



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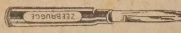

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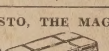
2/9  2/9

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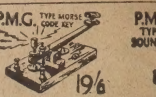

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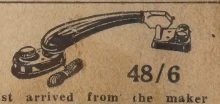

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